





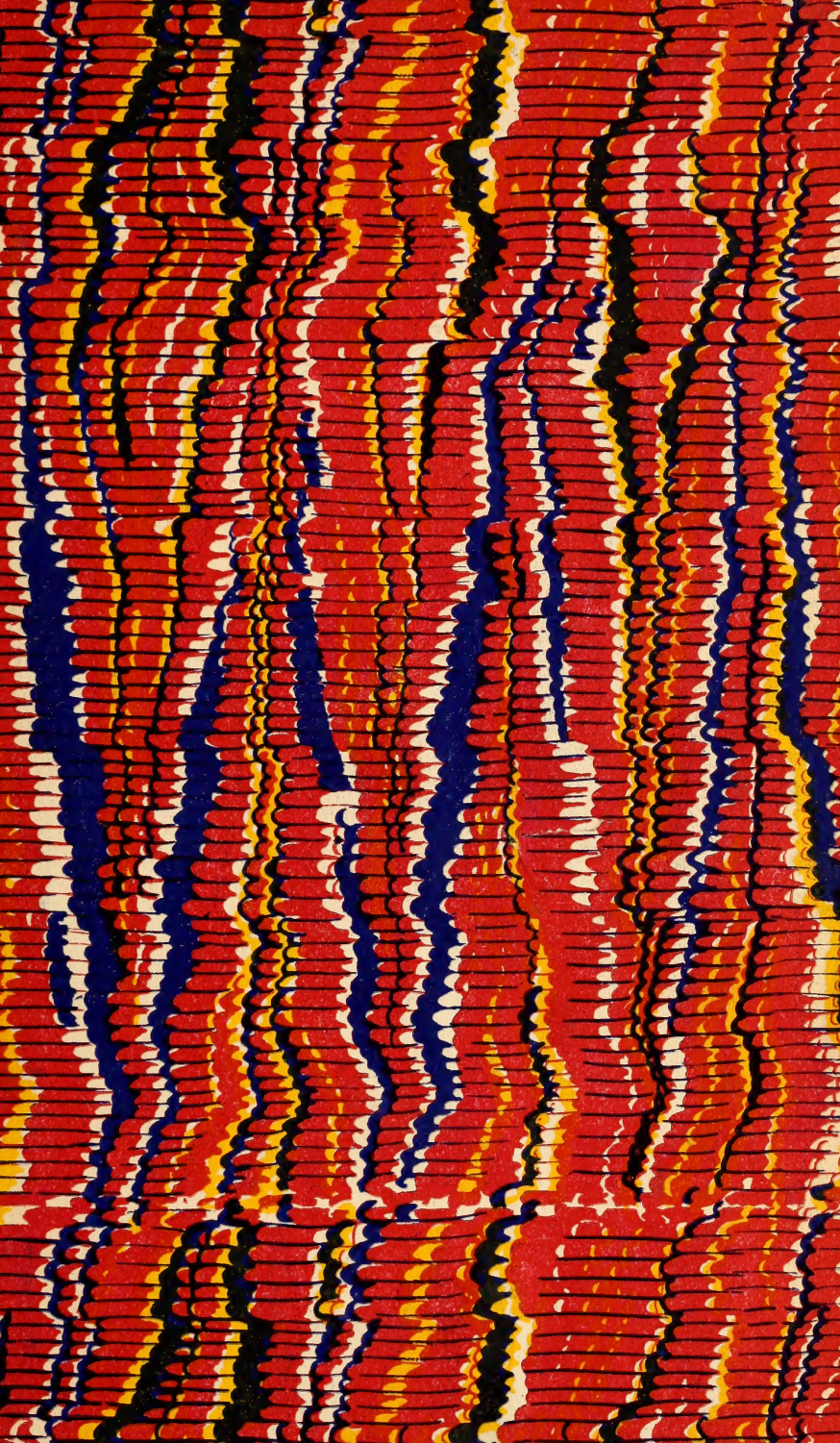


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REPORT OF  
THE SECRETARY OF  
AGRICULTURE - 1924



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# REPORT

OF THE

## SECRETARY OF AGRICULTURE



1924



WASHINGTON  
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1924



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## REPORT OF THE SECRETARY OF AGRICULTURE

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WASHINGTON, D. C., *November 15, 1924.*

TO THE PRESIDENT:

It becomes my solemn duty, Mr. President, to transmit the annual report prepared under the direction of the late Secretary of Agriculture, Henry C. Wallace. Although Secretary Wallace did not have an opportunity to consider the report in its final form, it has been carefully reviewed by representatives of the department who have been in close touch with him and who worked with him in its preparation, and is believed to represent his views regarding the state of agriculture and the work of the department during the period it covers.

It is regrettable that the lamentable death of Secretary Wallace leaves his annual report in the present status. The method pursued in submitting this report appears to be the only practicable one to meet the situation that presents itself.

Respectfully,

HOWARD M. GORE,  
*Acting Secretary of Agriculture.*

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The report as prepared under the direction of Secretary Wallace follows:

Prospects are that the gross income from agricultural production in the United States for the crop year 1924-25 may reach approximately \$12,000,000,000, compared with \$11,500,000,000 in 1923-24 and \$9,550,000,000 in 1921-22. While much further recovery is required to bring it back to its pre-war condition, American agriculture, on the whole, is in the best position it has held since 1920. Prices of many crops are at the highest point in four years, and costs of production have declined somewhat from the high point of the depression period.

A favorable readjustment has taken place in price ratios between agriculture and industry, due partly to an advance in prices of the things farmers have to sell and partly to the decline in the prices of the things they have to buy. While the purchasing power of farm products is 18 per cent below the pre-war level it is 16 per cent above the index for May, 1921, when the depression was in its worst period. Farmers have made crop readjustments which helped to bring the various lines of production into better balance.

## THE CROPS OF THE YEAR

This year's harvest was the finest in five years. Though not the greatest in volume of products, it was the best balanced and represented the best income. The total acreage in all crops in 1924 is estimated to have been about 370,000,000 acres. This was a decline of about 3,000,000 acres from the area planted in 1923, and a decline of 6,000,000 acres from the area planted in 1919, when the last census was taken. Indications on October 1 were that the final yield per acre of crops as a whole would be 3.5 per cent below the average during the last 10 years.

Yet it would be a mistake to conclude that the American farmer is done with the troubles of the depression period. If the readjustment is left to blind economic forces it will be many years before that can be said. Although farm commodity price levels are headed toward a better position, they have still a large gain to make before agricultural products will be on a parity with other products. This means that agriculture is still laboring under a heavy disadvantage.

The improvement that has taken place has not yet lasted long enough to produce any marked betterment in the finances of the farmer. As a matter of fact, the suffering of many farmers is perhaps as intense to-day as it was in the first years of the depression period, because the effects of the depression are cumulative. Present favorable possibilities will have to be turned into realities before it can fairly be said that agriculture is again enjoying normal prosperity. Nevertheless, the showing of 1924 brings prosperity nearer.

For wheat production the year was extraordinarily favorable. Large yields of good quality grain have been harvested almost everywhere. The wheat crop is estimated at 856,000,000 bushels, compared with 786,000,000 bushels last year, or an increase of 70,000,000 bushels. Average annual wheat production for the last five years has been 854,000,000 bushels.

Yields of wheat have been particularly satisfactory in the Great Plains area and in adjacent States from North Dakota to Texas. In the Pacific Coast States, however, severe drought curtailed production.

The spring wheat crop, including durum, has been extremely satisfactory. Yields in most sections have been so far above the average that in spite of a reduction of acreage estimated at 33 per cent since 1919 a crop of 266,000,000 bushels was forecast October 1, compared with 213,401,000 bushels last year and an average of 228,000,000 for the last five years.

The corn crop is estimated at 2,458,809,000 bushels, as compared with 3,046,387,000 bushels in 1923 and 2,906,000,000 bushels in 1922. An unfavorable season brought about a greater percentage of soft



corn than for many years. Good corn prices had encouraged heavier planting and in March farmers reported an intention to increase their corn acreage by 3 per cent, but a wet spring hampered planting and reduced the effective area to 105,604,000 acres. Growing conditions were particularly unfavorable in the Middle Atlantic States, in Ohio, Indiana, Michigan, and Wisconsin, and in the Gulf States.

Cotton production was estimated on October 8 at 12,500,000 bales, compared with 10,140,000 bales a year ago and a five-year average of 10,543,000 bales. The acreage in cultivation was about 4.4 per cent above that of 1923 and made a total of around 40,400,000 acres. Delayed planting, however, and replanting with inferior seed, brought stands of cotton down below the average. On the other hand, boll-weevil and other pest damage was less than in the last three or four years, so that a fair crop was realized. Yields, moreover, were more evenly distributed than in 1923.

The potato crop is estimated at 423,500,000 bushels. This is slightly more than the crop of 1923 and considerably more than the five-year average of 390,722,000 bushels. Though the potato acreage was much less than in recent years, unusually favorable weather resulted in a larger crop. Sweet potatoes, however, are a very small crop this year, total production being estimated at 74,000,000 bushels, compared with 97,000,000 bushels last year and a five-year average of 101,000,000 bushels.

Indications are that tobacco production will be nearly 1,182,000,000 pounds. This is about 300,000,000 pounds less than last year's crop and about 200,000,000 pounds below the five-year average. The tobacco area was 140,000 acres below that of 1923 and 73,000 acres below the five-year average. But the income return from this reduced crop may be as profitable to the producers as the return would have been from a larger crop at lower prices.

Beet-sugar production was forecast in October at 950,000 short tons, compared with 881,000 short tons last year. The sugarcane crop in Louisiana was short. Because of light yields and the necessity for holding cane for seed, it is estimated that somewhat less than 160,000 tons of cane sugar will be made in Louisiana this year, compared with 162,000 tons last year and 295,000 tons in 1922.

The vegetable crop acreage increased in 1924, and about 2,200,000 acres were planted in 16 crops in truck-farming areas compared with 1,800,000 acres in these areas in 1918. In 1923 the farm value of 16 leading truck crops was estimated at more than \$300,000,000. It is believed the value of the 1924 vegetable crop will be equal to that of last year.

Feed crops other than corn gave bountiful yields. Preliminary forecasts are for an oat crop of 1,509,000,000 bushels, compared with the five-year average (1918-1922) of 1,303,000,000. A barley crop

of above average has been harvested, with an estimated production of 201,000,000 bushels, compared with a five-year average of 186,000,000 bushels. Production of tame hay was estimated at 95,000,000 tons compared with a five-year average of 85,900,000 tons. Estimated production of wild hay is 14,000,000 tons.

#### IMPROVEMENT UNEQUALLY DISTRIBUTED

Though the crop story of 1924 spells improvement to agriculture as a whole, the improvement will not be shared equally by all sections of the farm population. Grain producers, who had a cash income from sales in 1923 of about \$920,000,000, may earn this year approximately \$1,210,000,000. Of this prospective increase of \$300,000,000 the wheat growers stand to gain by far the greater share. Wheat growers in hard winter and spring wheat areas will gain more than other wheat growers.

Corn in October was bringing 30 to 35 cents a bushel more than in October, 1923, but corn growers will have less corn to sell this year owing to the reduction both in the yield and the quality of the corn crop. In some corn States, however, particularly Illinois and Indiana, the unfavorable corn prospects will be offset by gains in cash returns on oats. As a whole the Corn Belt must look for increased returns from higher hog prices. Based on data available for the first eight months of the present year it is estimated that total hog slaughter will probably amount to approximately 75,000,000 head compared with 81,000,000 in 1923, 67,000,000 in 1922, and 62,000,000 in 1921.

Hogs at the farm are now selling at \$8.50 a hundred pounds. This is about \$2 over the price of a year ago. At this price level the cash income of hog producers during the 1924-25 hog marketing season should be equal to that of last year, notwithstanding a prospective reduction in marketing of not less than 20 per cent.

Cotton growers realized about \$1,520,000,000 from last year's crop. An average price of approximately 25 cents a pound would be necessary to realize an equal income from this year's estimated yield of 12,500,000 bales. In the first month of the crop movement the cotton growers received only 22 cents a pound. At this writing they are getting 22 to 24 cents. Although these prices are below those of last year, the large cotton crop should enable the South to hold its relatively satisfactory position.

Cash returns from dairy and poultry products do not promise to exceed last year's income from sales of \$1,980,000,000. Marketing of poultry products during the first nine months of 1924 was less than in the same period of 1923, and it is possible the peak of poultry production has been passed. In dairying production continues to in-

crease, but heavier marketing may not result in a greater income. There is no certain prospect of increased income from cattle and sheep production. Probably the returns will be about the same as those of last year.

#### FINANCIAL CONDITION IMPROVED

In the main it may be said that the year will bring increased income to the surplus grain-producing regions, to the Corn Belt, and possibly to the Cotton States. The tobacco, fruit, vegetable, and dairy producing States probably will not contribute much to the estimated increase in the gross agricultural income of the year. I have already mentioned that the income from agricultural production in the United States for the crops of the year 1924 may be \$500,000,000 more than that of last year. Returns on the estimated present value of farm capital from this income, if operating costs were not greater than those of the crop year of 1923, would amount to 3.8 per cent. This return is much below the average return to other capital. Moreover, production costs for 1924 may turn out to be slightly greater than those for the preceding year. Nevertheless, the showing is gratifying when compared with that of the last few years.

Income from agriculture has not in any year since the price decline of 1920 sufficed to allow both a commercial return on capital and adequate rewards for the farmers' labor, risk, and management. Yet it has shown a gradual improvement in the last three years. In 1920, after deducting operating costs and a wage allowance for the farmers' labor, and before paying interest on debts, the net income on the current values of agricultural capital was only 0.6 per cent. It increased to 1.4 per cent in 1921. It made a further gain to 3.1 per cent in 1922 and 1923. The indicated further improvement to nearly 3.8 per cent for the present crop year thus represents a very substantial advance from the low point of the depression period. These returns, however, are made on a capital valuation that has been scaled down. Thus the real gain is not as large as the apparent gain.

The drop in the gross income of agriculture from \$15,800,000,000 in 1919 to \$9,550,000,000 in 1920 roughly shows the extent of the disaster suffered by agriculture from the fall of prices. Similarly the improvement already cited in the gross income of the industry as a whole since 1920 measures the general betterment that has taken place. But perhaps the rewards to actual farm operators may come nearer to indicating the position of the average farmer. Actual farm operators, after paying interest on borrowed capital and rent on rented farms, may earn approximately 2 per cent on their own capital investment in the crop year 1924. This compares with a loss



of 3.1 per cent on their capital investment in 1920, a loss of 1.4 per cent in 1921, and a profit of 1.5 per cent and 1.4 per cent in 1922 and 1923.

Farm purchasing power, as measured by the quantity of things for which a definite amount of agricultural commodities can be exchanged, has improved somewhat in the last 12 months. Although the index number of prices paid to producers of 30 farm products was the same in September, 1924, as in September, 1923, the price level of nonagricultural goods had declined. There was consequently an increase in purchasing power of farm products in terms of nonagricultural products. Thus in September, 1924, the ratio of farm prices to wholesale prices of nonagricultural goods was 82, compared with 78 in September of 1923, while the average level of farm prices remained about the same there were important changes in prices of some products. Farm purchasing power in some localities has been materially increased by large yields of crops that have brought good prices.

#### IMPROVEMENT IN WHEAT SITUATION

Improvement in the wheat situation has been the outstanding event in the agricultural history of 1924. As the year began the world grain market situation was more favorable than at any time since the general price deflation of 1920-21. Apparent surpluses of bread grains had been much reduced and the world's crop promised to be between 300,000,000 and 350,000,000 bushels below that of last year. Exportable surpluses in the principal producing countries were reduced and requirements of the importing countries were increased. Indications were that wheat would continue throughout the crop year on a price level considerably higher than that of the crop year 1923. Total production of wheat in the Northern Hemisphere outside of Russia and China was estimated to be about 2,750,000,000 bushels, compared with 3,045,000,000 bushels last year. Russia seemed unlikely to export wheat, whereas last year she exported about 25,000,000 bushels. Wheat crops of the Southern Hemisphere were estimated not to be larger than those of last year. The world rye crop, an important factor in the world wheat market, was approximately 100,000,000 bushels short of last year. It is figured that the total world's supply of bread grains for 1924-25 will be probably 10 per cent less than that of the preceding crop year.

The demand for wheat from the United States should be stronger than it was last year. Europe, outside of Russia, is short more than 100,000,000 bushels of wheat and approximately 100,000,000 bushels of rye. North Africa and Russia are out of the market. Canada, our most important competitor, will have at least 150,000,000 bushels less wheat than last year. High prices may result in lessened con-

sumption of wheat in importing countries, but Europe and the Orient together will undoubtedly take all the wheat available for export from the United States at prices considerably above those of a year ago.

Nature has been good to most of the wheat farmers of the United States this year. She has given them large yields per acre and a total crop larger than that of last year on a reduced acreage. Reduced yields in foreign countries have brought about a market situation in which the American farmers are receiving higher prices for a larger crop. It seems reasonable to expect that the price farmers will receive for this year's crop will average about \$1.15 or better for the year. At this price the cash income from the wheat crop, as estimated October 1, would amount to about \$800,000,000, compared with approximately \$570,000,000 last year.

Nevertheless, the rise in the price of wheat has not yet sufficed to give a bushel of wheat its pre-war average purchasing power. A suit of clothes which cost the farmer of North Dakota 21 bushels of wheat in July, 1913, would have cost him 24 bushels in August, 1924. An average farm price of wheat in the United States on August 15 of \$1.40 a bushel would have been necessary to give that grain its pre-war purchasing power. Moreover, not all the wheat farmers of the United States will share in the increase in income from wheat production. Although producers of hard red winter wheat in Kansas, Nebraska, and Oklahoma, and producers of spring wheat in the States east of the Rocky Mountains, may approximately double their 1923 cash income, the States west of the Rocky Mountains and the important wheat-growing regions east of the Mississippi will have lower incomes because of reduced production.

Probably the increased wheat production in the four spring wheat States east of the Rocky Mountains will nullify the effectiveness of the protective tariff on wheat. Most of the wheat produced in this region is purchased by American millers. Mills last year consumed 14,000,000 bushels of Canadian wheat, upon which duty was paid, in addition to 114,000,000 bushels of American spring wheat. The indicated supply of American spring wheat this year, however, considerably exceeds the probable domestic consumption. Spring wheat therefore rests on an export basis, with its prices determined in the world market. In the last few months prices at Minneapolis have been lower than at Winnipeg. Whether or not this relationship will continue throughout the year will depend largely on the movement of the crop.

It is therefore evident that, while the wheat situation has greatly improved, it has not yet reached a point where farmers should think no further readjustments are necessary. It would be a mistake to suppose that the wheat acreage may again be expanded with the

expectation of high prices. Production costs and transportation rates are still high. Important competing countries will not have partial crop failures or low yields every year, and wheat production in Canada will probably continue to expand. Russia will not be permanently out of the wheat market. So long as the United States produces a surplus of wheat the price of the crop will be determined largely in the markets of the world and the American farmers will have to meet keen foreign competition, unless some means is provided for making the protective tariff effective.

#### COTTON SITUATION STEADY

Although cotton prices are substantially lower now than they were at the beginning of the present year; the outlook is still promising to the cotton grower. When the cotton season of 1923 and 1924 closed on July 31 the world supply of American cotton was at the lowest ebb for 25 years, although the world consumption of American cotton during the season had been over a million bales less than that of the previous year. With a cotton crop estimated as of October 1 at 12,500,000 bales there will be with the world carry-over a supply of approximately 15,000,000 bales. This crop should contribute approximately a billion and a half dollars to the purchasing power of the cotton growers. A good feature of the cotton situation is the uniform distribution of the crop. Georgia, Mississippi, Arkansas, and Oklahoma, where yields last year were low, all have good crops this year.

Cotton recovered more quickly and definitely from its deflation in 1920 than any other important staple. It has been in a satisfactory position from the standpoint of price since 1922. In some parts of the Cotton Belt, however, the recovery from the depression has been impeded by drought, the boll-weevil and leaf-worm damage. Increased boll-weevil destruction and unfavorable weather in the South Atlantic States so reduced yields in 1921 and 1922 as to offset the advantage of the advance in prices. In general, growers of long-staple cottons have not enjoyed a proportionate share of the prosperity which has come to the cotton growers as a group. This is due principally to the large supply of foreign-grown, long-staple cotton, and to reduced demand for all varieties of long-staple cotton.

Industrial prosperity in the United States in recent years has given rise to domestic demand for raw cotton running close to 6,000,000 bales a year. This is approximately 60 per cent over pre-war amounts. Exports, although below pre-war figures, have roughly equaled domestic consumption. Three abnormally small crops failed to meet the requirements of this market situation. It is estimated that from 1921 to 1924 production failed by more than 7,000,000 bales to restore withdrawals from the world supply.



To this situation the price level has had to adjust itself frequently. From the low point of the 1920 and 1921 decline, values doubled within three months. Thereafter, they continued generally upward, reaching their peak for the period at 37.15 cents on December 1, 1923. In this period experience confirmed the rule that shortened cotton crops are not generally unprofitable. Small crops may bring high prices and mean a proportionately larger available labor supply for gathering. On the other hand, they tend to a reduction of the permanent local labor supply. There has been a drift of negro labor away from the South in the last few years which may impair our cotton producing power. Yet cotton yields this year have, for a time at any rate, set at rest any fear that American cotton production will not again be able to meet the world demand.

As a means toward the improvement of cotton-marketing methods the establishment by the department of uniform standards of quality must take a place in the front rank. Such standards were authorized and prescribed for the American cotton futures markets as early as 1914. It was not until 1923, however, that Congress in passing the United States cotton standards act directed the general adoption of these standards for the sale and purchase of spot cotton in interstate and foreign commerce. Most of the important cotton exchanges have now adopted the American cotton grades under the name of universal standards. Their general use has enabled growers for the first time to sell their product on the same system of classification as that on which the spinner buys. Benefits of this development are brought home to the grower through licensing of qualified classers as public cotton graders. The same end is promoted by the issuance of classification certificates by authorized employees of the department. General adoption of standardized grading of cotton and the establishment of universal standards have resulted in greatly increased demands for copies of those standards. In 1924 the output of such copies exceeded 10,000 or approximately five times that of 1921. Applications for copies of the standards have reached such a total that the resources of space and funds available for the work are inadequate.

#### VEGETABLE ACREAGE INCREASED

One of the most interesting recent developments in agriculture has been the increase in the acreage devoted to vegetable crops for shipment to outside markets. In 1924 there were about 2,200,000 acres planted in 16 crops in truck-farming areas, compared with 1,800,000 acres in 1918, an increase of about 22 per cent. The most notable increase occurred in the acreage of lettuce, of which about 63,000 acres were harvested in 1924, compared with about 16,800 acres in 1918. The increases occurred largely in the development of new terri-

tory in the West and on the Pacific slope. Colorado increased from 150 in 1918 to 5,600 acres in 1924; Idaho from none in 1918 to 3,150 acres in 1924; and California from 7,600 to 31,290 acres. There were notable increases in New York and in the South also. Acreage of peas for table consumption nearly doubled during the period; spinach more than doubled; while watermelons increased from 90,000 to 169,220 acres. The two staple crops, cabbages and onions, show no sustained increase during the period, nor is there any marked increase in the crops produced for canning as a whole.

#### BAD YEAR FOR LIVESTOCK

Although 1924 was not a year of good profits for cattle and hog producers, it is nevertheless true that the livestock industry of the country is now on a firmer foundation than at any time since the price collapse of 1919 and 1920. Cattlemen have had a harder time than any other group of livestock producers. Slow but steady liquidation has been going on in the cattle industry for three years. To-day, however, many of the war-time loans, with their high interest rates, have been paid. Money is available on more favorable terms, conditions in the cattle country are improving, and the prospective reduction in hog raising should strengthen the market for beef.

Conditions, however, are not yet satisfactory in the cattle industry. In August, 1924, beef-steer prices at Chicago were lower than in the corresponding month of either 1922 or 1923. They were only \$2.60 a hundred pounds higher than the low point of 1921. When the collapse of markets came commercial banks and Government agencies joined in an effort to save the cattle industry from ruin. Loans were made and renewed, interest rates were reduced, and liquidation temporarily deferred in the hope that prices would again advance to a point at which the range cattleman could meet his obligations. This hope has not yet been realized.

The position of the beef-cattle producer has been hurt by expansion in the numbers of dairy cattle. All dairy cattle go to slaughter eventually and the growth of the dairy industry makes a substantial addition to the meat supply. Heavy slaughter of hogs and the competition of cheap pork products have also been a handicap to the beef-cattle producer. With no export outlet for beef products, our present annual production of cattle seems to be larger than can be marketed at profitable prices. The best present policy for cattle producers would seem to be to raise fewer and better cattle.

Swine producers have grounds for encouragement. Price deflation in 1921 carried hog prices down almost to the pre-war level. Ordinarily this would have meant reduced hog raising. But though hogs were low, corn was lower. Hence hogs offered the most profit-

able outlet for corn. Hog production in the Corn Belt accordingly increased around 30 per cent in 1922 and another 5 per cent in 1923. Inspected slaughter in 1923 was 53,300,000 head, or 10,000,000 more than in any previous year. Inspected slaughter to date in 1924 has been even larger. In such an overbalanced supply position prices have naturally been unprofitable.

The period of excess production is now apparently ended. A survey made in June, 1924, indicated a decrease, compared with the previous year, of 21 per cent in the number of sows that farrowed. There was a reduction of 20 per cent in the number of pigs saved last spring compared with the number saved in the spring of 1923. A reduction of 6 per cent in the number of sows bred or to be bred to farrow this fall and of 10 to 15 per cent in fall pigs was also indicated. With such a reduction in supplies, and with prospects of a continued broad foreign demand for pork and pork products, the swine producer should soon again be able to set his records down on the profit side of the ledger.

#### SHEEPMEN IN GOOD CONDITION

Sheepmen are in a much more favorable position than cattle or hog producers. Prices of wool, sheep, and lambs made a quick recovery from the 1921 slump and have since maintained a level not only much above those of other agricultural commodities but above the price level of all commodities. This favorable situation has been largely due to the fact that breeding stock in the sheep industry was greatly reduced after the war, first by heavy marketing from the range country in 1919 on account of drought, then by heavy losses in the winter of 1919 and 1921, and afterwards by liquidation of breeding stock in the Eastern States on account of the depression of prices in 1921.

To-day world stocks of both sheep and wool are below normal. Wool prices are advancing in world markets and there is an excellent demand for both fat and feeder sheep and lambs. The price situation is encouraging expansion in the production of wool and lambs. Lamb prices in August, 1924, were about 58 per cent higher than during the low time of 1921 and wool prices were about 104 per cent higher. Sheepmen are accordingly in good shape. But it is important to bear in mind that the sheep industry is subject to cycles of large production and low prices, and reduced production with high prices. In periods of high prices, therefore, producers should be cautious about stocking up too heavily with the expectation that prices will remain high.

Wool producers have enjoyed prosperity in 1924. Present prices for the bulk of the wool clip are almost 100 per cent above the prices



paid in the second half of 1920 and nearly 200 per cent above the prices of 1913. While these percentages of increase are less than those of some lower-priced farm commodities, they probably represent a larger net gain to the producer than that accruing from improved prices in most other agricultural activities.

Fine wool in October was worth \$1 per scoured pound more than in the corresponding month of 1913 and 75 cents more than in the corresponding month of 1920. Nevertheless, the domestic price was below the world importing level. This was due to a temporary decline in the import demand for wool.

Normally the United States is a heavy importer of wool. When it is buying foreign wool in the usual quantity, the domestic price is naturally about equal to the foreign price plus the tariff. This condition did not exist in October because in 1924 domestic consumption of wool materially declined. In the persistence of an import-price level above the domestic price level, American woolgrowers had a promise of still higher prices for their commodity as soon as the demand for it should once more compel the resumption of normal imports.

Consumption of wool in the United States in the first seven months of 1924 was 25 per cent less than in the corresponding period of 1923. Imports in the same period showed a decline of 47 per cent. Yet in spite of decreased mill consumption and slackened import demand prices for wool advanced. With an increasing population in this country to be clothed and with world competition for the available supply of wool increasing, the American woolgrower has a good prospect of continuing prosperity.

It is worth noting that while the American woolgrower has in the last few months not been getting the full benefit of the tariff, he has benefited substantially from it in the last few years. Under the tariff act of 1922 most of the wool imported into the United States pays a duty of 31 cents per pound clean content. In the last two years the price of fine territory staple wool in Boston has at times been as much as  $32\frac{1}{2}$  cents above the price of a comparable grade of wool in London. This margin is substantially the amount of the tariff plus the cost of transportation. In 1923 the average excess of the Boston price over the London price was about 23 cents per pound. This year the spread, owing to decreased wool consumption in the United States, has been greatly diminished. Obviously, however, this is an effect of the abnormally low import demand, which should pass away as American wool consumption increases. It should be borne in mind, moreover, that were the duty not in existence foreign supplies of wool would be more readily available to importers. This would tend to depress the home market.

## DAIRY PRICES UNSETTLED

Conditions in the dairy markets were unsettled during the first nine months of 1924. Prices in the early part of the year followed an uncertain course. The low point of the usual spring decline of butter prices was reached in April, a month before flush production began. September opened with a quantity of butter in storage of 156,232,000 pounds, an increase over last year of 53,500,000 pounds. This heavy surplus was an occasion for concern, because up to October 1 prices remained below storing prices so that it was impossible to move storage holdings except at a loss.

An encouraging development toward the end of the year was the firm tone of foreign markets, which eliminated the possibility of large imports into the United States. In the early part of 1924 and during 1923 imported butter was a considerable factor in the market situation. Domestic production of butter, however, appears to be running about 8 per cent heavier than a year ago. Thus, the heavy storage surplus, notwithstanding the prospect of diminished imports, means that consumption must be materially increased if the season ahead is to pass without a price decline. What has been said regarding butter pictures in a general way the trend of other dairy products. Dairymen, moreover, are beginning to feel the pressure of higher feed prices.

On the whole, however, dairying has been one of the bright spots of the agricultural situation since 1921. Though prices of dairy products slumped in that year they came to a stable basis on a higher level than that to which farm commodities generally sank. This was partly due to the fact that dairy products, unlike wheat and livestock, usually find a broad market at home and are therefore comparatively unaffected by conditions in other countries.

Progress continued in our dairy industry, with the result that the number of milk cows in the United States increased from 23,594,000 on January 1, 1921, to 24,675,000 on January 1, 1924. Milk production increased from nearly 90,000,000,000 pounds in 1920 to nearly 110,000,000,000 pounds in 1923. Total output of dairy products in the first eight months of 1924 showed an increase of between 7 and 8 per cent over the output of the price period of 1923.

The increased dairy production has been readily consumed, but at lower prices. Indeed, the United States last year, besides consuming practically all its domestic output of dairy products, imported the equivalent of 20,000,000 pounds of butter. In the first seven months of 1924 imports of butter were larger than in the same period of 1923. Dairying conditions were specially favorable in 1923. Farm value of dairy production in that year exceeded \$2,500,000,000, or

\$115,000,000 more than in 1921. Though in the first eight months of 1924 the prices of butter and cheese were somewhat lower than in the corresponding period of 1923, the decline was not sufficient materially to hurt the industry. In the main the outlook continues favorable, because the domestic market for dairy products is extending and improving.

Dairy farmers, however, should keep an eye on the foreign situation. For the last 10 or 15 years the market for dairy products in this country has been to a considerable extent independent of the dairy markets of other countries, since our production has very nearly equaled our consumption. With the rehabilitation of European agriculture, now well under way, this position may undergo a change. Dairy production has been expanding in Europe as well as in the United States. High prices prevailing for dairy products in this country offer an attractive market for foreign producers which they will naturally seek to exploit. There is consequently a possibility that foreign competition will be an influence in our dairy product markets in the comparatively near future. While this possibility does not alter the fact that the immediate outlook for the American dairyman is favorable, it indicates that he should not consider the opportunity for expansion in dairying unlimited.

Market reports issued by the department on dairy products in the last four years have had a stabilizing influence on prices. Information published regarding production, supply and movement, demand and prices, not only in the United States, but in leading foreign dairy countries, has facilitated orderly marketing and helped farmers to plan their future production wisely. "Milk for health" campaigns carried on by the department have undoubtedly helped to increase the consumption of dairy products. The department has also assisted in the organization of cooperative associations for the distribution of dairy products. Near large cities, where the problem is primarily one of marketing milk through distributors and in some cases directly through producers' cooperative distributing plants, farmers have been aided in working out plans of organization, financing, and methods of operation. In butter and cheese producing territory the problem is frequently that of efficiently selling the output of cooperative creameries and cheese factories through associations or federations of similar organizations. The department has been able in many cases to assist in the federating process.

#### FOREIGN MARKET SITUATION

Nearly one-half of the export trade of the United States consists of agricultural products. This fact has sometimes led to the hasty assumption that the decline in prices of agricultural products in 1920-21 was due to the inability of Europe to buy its normal



quota of our farm production. As a matter of fact, our agricultural exports, instead of declining, increased for a time after the war. Our exports of wheat, corn, and rye during the years of low prices not only averaged much greater than in the pre-war years but were even greater than during the war years. This was likewise true of pork and pork products which make up our largest meat exports. It was equally true of tobacco.

These figures dispose of the myth that the farm depression was due to loss of export markets. Europe bought our farm products all the more freely because we were selling them at bottom prices. But we had more foodstuffs to sell than Europe could absorb at prices remunerative to our farmers. This overbalanced supply situation is now being corrected. The last two years have seen a decline in exports from the high levels of 1918 to 1922. In the year ended June 30, 1924, the volume of our agricultural exports was only 4 per cent above the average for the five pre-war years. Probably we must be prepared for a further decrease in our farm exports. European agriculture is getting back to its pre-war productiveness and the competition of other surplus food-producing nations whose land and labor are cheaper than ours is increasing in the European market.

How unlikely it is that an increase in the foreign demand for our farm products will by itself bring about better prices is apparent when we consider the competitive situation among food-exporting countries. Canada, which had an average crop of 197,000,000 bushels of wheat from 1909 and 1913, produced 301,000,000 bushels in 1921, 400,000,000 bushels in 1922, 470,000,000 bushels in 1923, and over 300,000,000 bushels this year. Argentina, whose average annual production from 1909 to 1913 was 147,000,000 bushels, has produced in the last four years an average of more than 200,000,000 bushels. The shortage of American cotton has led to systematic efforts in other producing countries to increase their output. There seems in short to be no basis for the hope that the economic rehabilitation of Europe will increase the market for our foodstuffs, because the tendency of this rehabilitation to increase the demand for American grain and meat and fibers is offset by the heightened competitive situation among the agricultural exporting nations.

Our two best foreign customers have been the United Kingdom and Germany. Probably the United Kingdom will continue to import from the United States cotton in decreased volume, tobacco in constant or perhaps increasing volume, pork products as long as the price remains low and in reduced quantities at higher prices, wheat and flour in small quantities varying with the competition from Canada and Argentina, foodstuffs when crops are short in competing countries, fresh fruits in relatively small quantities, dried fruits in

fair volume, glucose and perhaps other specialized grain products. A study of German conditions leads to the conclusion that we may hope for a market in Germany during the next few years for perhaps eight hundred to nine hundred thousand bales of cotton. Probably the German market will be good for pork products and fats as long as prices remain low. German purchases of grain from us will probably depend on what Russia has to offer. Our tobacco exports to Germany should continue. On the whole, however, our sales to Germany will probably be less than during the five pre-war years. In 15 or 20 years we shall not have the same need for a foreign market. By that time our population should have grown large enough to consume most of what we produce. Meantime we must be careful not to build excessive hopes on the possibility of increased foreign sales.

#### LIVESTOCK DISEASE OUTBREAK

The outbreak of foot-and-mouth disease in California in February created the most urgent demand for the services of the department during the year. This outbreak was the most serious menace to American livestock in recent years. Fortunately, the Department was better prepared than ever before to deal with such an emergency. Plans had been worked out in advance and printed matter and other supplies provided. A picked force headed by trained and experienced veterinarians was placed at work in the affected territory. State and local authorities in California heartily cooperated with the Federal forces and supplied valuable assistance. On the few previous occasions when this highly contagious malady gained entrance into the United States it was brought under control and finally eradicated by methods of quarantine, disinfection, and slaughter. This policy was again followed. Strict quarantines were imposed, all affected and exposed animals were slaughtered and buried and infected premises were disinfected. Indemnity based on appraised value was paid to owners of animals and property destroyed. By the end of June the outbreak had been brought under control. Only a few sporadic cases have since occurred.

In the fight against the disease up to June 30 there were slaughtered 49,781 cattle, 24,978 sheep, 20,996 swine, and 808 goats. Indemnity charges for animals and other property amounted to \$3,800,000, chargeable half to the Federal Government and half to the State of California. Suppression of the disease presented unusual difficulties because the infection spread to horses and flocks on the open range and in the rugged mountain country. In the more rocky regions the problem of burying large herds was especially perplexing. In some instances cattle were driven into a rocky canyon and there killed, and the side of the canyon blasted down with dynamite to bury the carcasses.

Foot-and-mouth disease has ravaged the herds of Europe and other parts of the world for many years, causing tremendous losses. Where it has become firmly established its eradication has proved to be economically impossible. Scientific studies have so far failed to provide effective means of control. Hence the department has declined to risk infection of the American livestock industry by permitting the harboring of the virus for purposes of experimentation and treatment. It has adhered rigorously to the effective policy of slaughter. The source of the latest outbreak in this country has not been discovered. The disease first appeared in hogs fed garbage shipped from the Mare Island Navy Yard in San Francisco Harbor. It therefore seems probable that the infection was carried by shipments from the Orient.

#### STATE OF AGRICULTURE DURING PAST FOUR YEARS

In the administrative period now drawing to a close American agriculture has been faced with problems of unexampled seriousness and difficulty. It has suffered the shock of a major economic crisis, from which it sustained more damage than any other branch of production. This crisis was followed by an uneven price readjustment whereby the exchange of goods and services between town and country came to stand on a footing highly disadvantageous to the farmer. It now seems that the corner has been turned. Although the farmers as a class do not yet receive compensation for their services on a parity with that received by other economic groups, they are getting substantially more than when the present administration took office.

In these circumstances it seems advisable in this report to depart from the usual custom of reviewing only the agricultural history of the last 12 months and to glance instead at the entire period since the depression began in 1920, sketching briefly how the farmer has been affected and outlining the contributions of the department to the solution of the farm problem.

It is worth noting that the depression struck American agriculture in a transition period. Within a decade it had increased its production 15 per cent, not by increasing the number of farm workers, but by increased efficiency. Rejuvenation of equipment was in full swing. Road horses were being exchanged for automobiles. Some regions were introducing tractor power. A great program of pure breeding and disease control was under way in the livestock industry. Farmers everywhere were pushing ahead to a better living standard.

All this development was checked by the postwar crisis. The increased productive efficiency which normally would have meant prosperity brought bitter fruit instead. Buying of new materials



and replenishment of equipment stopped. Farmers ceased to buy tractors and depended on horsepower. Great herds of livestock were dispersed. The South was handicapped in its fight against the boll weevil. Standards of living were reduced. Farmers drew on their cash reserves and on the equity in their land, and debt accumulated. In short, the condition by the end of a decade of extraordinary progress in agricultural efficiency was the reverse of what might have been logically expected.

The depression which began in 1920 was not merely a stretch of lean years, such as farmers have had to go through before. It was a financial catastrophe, the full effect of which can not yet be measured. Though all parts of the country have not felt this depression equally, no region has escaped. Some regions may yet have to experience its full force. A large proportion of the most efficient and energetic producers occupying the best lands of the country have been hard hit through no fault of their own.

So extreme and one-sided was the drop in prices that the farmers were unable to believe it could last. This mistake, in which they were often confirmed by business men and bankers, aggravated the trouble. Farmers held on and in many cases borrowed money to pay interest and taxes and to meet current expenses. As the depression continued the load of debt increased. Many farmers became discouraged and turned over their property to creditors. From this situation the nation suffered as well as the individual farmer. It is true that most farms whose ownership changed as a result of the depression continued to produce. Frequently, however, they were no longer cultivated by proprietors with a permanent interest in maintaining soil fertility, but by renters since most of the farms that were foreclosed passed into the hands of non-farmers. An especially burdensome feature of the depression period was the fact that farm costs of production advanced while farm prices were declining.

Readjustment of prices after the war was inevitable and was expected. An equal readjustment, affecting the prices of the things the farmers have to buy in the same degree as it affected the prices of the things they have to sell, would have enabled agriculture to get through the readjustment period very well. But the uneven price readjustment that actually occurred left the farmers helpless. They were injured as much by this characteristic of the depression as by the speed and extent of the drop of prices. Three years of big crops did little to pull them out of their troubles. In fact, efficiency in farm production seemed to make matters worse. In 1922 the spread between the prices of farm products and the prices of factory goods widened. While industry was booming, agriculture sank to lower and lower levels of depression.

Now that the situation is on the mend, it will be worth while to record some of the effects of the depression because these effects can not be wiped out overnight. Total farm mortgage indebtedness in the United States has greatly increased since 1920. Some of the increase in mortgage debt probably represents new investment in land and in improvements. Most of it, however, has unquestionably been assumed to refund short-time loans to pay interest, taxes, and current expenses.

Tax delinquency has increased. This is especially significant because farmers do not willingly delay their tax payments but when possible borrow money to meet them. In some western areas local taxes have been delinquent for several years. An increase in taxes coincided with a decline in the means of payment. Total farm taxes absorbed in 1923 almost 7 per cent of the gross value of farm products compared with 4.9 per cent in 1913. Reports from 16,182 farmers in 1923 showed that their taxes averaged 17.6 per cent of their net farm returns. In most of the important farming regions of the country taxes on farm lands have gone up two to six times as rapidly as the value of the land. Taxes in the last few years have consumed from 10 to 50 per cent of the net farm income in large sections of the country. Tax burdens have been particularly heavy in the North and the West.

The increase in taxes has been partly due to increases in the cost of conducting public business. Other causes have been a natural tendency for Government activities to expand with the growth of population, and a drift toward extravagance growing out of optimism engendered by high commodity prices prior to 1920.

While a remedy is needed for this trouble, it is not clear that the best one is reduced public expenditures. In many cases taxes must be maintained at high levels to meet obligations already incurred. Nor should we profit in the long run by restricting the legitimate functions of Government.

Farmers often find their taxes too heavy because of the way in which they are raised. Taxes collected from farmers are usually based on a general property levy. They are levied upon the selling value of the property but are normally paid out of income. Too often the amount of the tax has little or no relation to the amount of the farmer's income. Selling values of land which serve as the basis for taxation do not rest only on current earnings but also on anticipations of future earnings. This often means that taxes have to be paid on fictitious values. Perhaps the general property tax system should be modified.

Another defect in our tax system which tends to increase the burden on agriculture is the fact that a large amount of personal property in urban centers escapes the tax assessor. Some tax evasions

are unlawful and others have the sanction of law. Among the latter are those made possible by the enormous volume of tax-exempt securities that has been issued. Farmers' wealth is mainly in the form of land and other forms of personal property which can readily be assessed. Farmers are consequently forced to pay a larger part of the total tax bill than their share of the national wealth warrants. To ease the tax burden on agriculture new sources of revenue should be tapped. This means of relief, coupled with a wider diffusion of public burdens, should be sought at the earliest possible moment.

It is not necessary to cite all the evidence of damage done to agriculture by the economic depression. One measure of the trouble is the fact that in the last four years 16 per cent of all bankruptcy cases reported to the Department of Justice have been farm bankruptcies, whereas in the pre-war years only 5 per cent of all bankruptcy cases involved farmers.

The department estimates that the average value of plow lands in the United States as a whole declined 27 per cent between March, 1920, and March, 1924. This decline in land values is important in view of the ratio of debt to the approximate value of farm lands. This ratio for owner-operated farms which in 1920 was 29 per cent had increased by 1924 to probably more than 40 per cent.

It may be well to point out that the farmers were not the cause but the victims of the land speculation which carried land values in some regions up to impossible heights in 1919 and 1920. The land boom was nourished mainly by business men and bankers in the country towns. When commodity prices dropped in 1920 many thousands of producers on farms were unable to meet their payments. Sellers usually extended the time for payment. They wanted the money, not the farms. But the shrewder buyers took the loss of payments already made and turned back the farms. Others who hung on for two or three years merely increased their losses. Many farmers who sold one farm and bought another expecting to pay for the second with the money received for the first were wiped out financially. Many renters were heavy losers as a result of the land boom. They lost their lifetime savings which they had put into first payments on farms.

Many farmers whose debts are very heavy are determined to save their homes and meet their obligations if given an opportunity. These men deserve encouragement. Considerations of good business, as well as fairness, should prompt creditors to make every reasonable concession which will permit them to hold their farms. If an extension of time for payment, a reduction in interest charges, or even a cancellation of part of his debt will enable the farmer to liquidate a major part of his obligation, which he would other-



wise have to default, both farmer and creditor should profit. On the other hand, the practice of encouraging farmers to keep on in the face of impossible odds, so that they continue making payments for a time only to be forced out when mortgages can be profitably foreclosed, must be disapproved.

The overproduction which brought about the collapse in farm prices resulted largely from the stimulus of advancing prices and from the response made by the farmer to patriotic appeals for increased production during the war. The stimulus to increase production did not cease when the armistice was signed. Some Government officials, economists, and commercial papers taught the doctrine of permanently high prices. Farmers were given every encouragement to maintain production at a high level. They were assured that a starving world overseas would take all they could produce at profitable prices. When this stimulus to production had resulted in a large accumulation of foodstuffs, the overbalanced supply position, aided by a campaign of price deflation, brought on a collapse of values.

In the slow and painful process of recovery from this situation perhaps the greatest single helpful influence has been the way farmers themselves have readjusted their production to correct the unbalanced position left by the expansion of the war period. There has been a decline in crop acreage marked by a tendency to return to the pre-war crop ratios. The acreage of wheat is gradually returning to the pre-war level. Since 1920 spring wheat acreage has been reduced about 20 per cent. Winter wheat acreage has been reduced about 8 per cent. In some parts of the Northwest flax has been substituted for wheat, and larger acreages of feed crops have been harvested generally. The area given over to wheat in the Corn Belt during the war period has been put back into corn.

Although overexpansion in certain branches of farming did not end until after the crops of 1920 had been planted, the readjustment process is now nearing completion. In the South the ravages of the boll weevil have encouraged a material increase in the cotton area, partly at the expense of corn acreage in that region. The decline of corn acreage in the South has tended partly to offset increased corn acreage elsewhere. Changes in livestock enterprises have kept pace with crop changes. Favorable returns from dairy and poultry products have brought about a great swing toward these enterprises, particularly marked in the case of dairying in the North Central and Western States. Swine and beef cattle production has been increased to keep pace with the greater production of feed crops. These changes, although they have much improved the situation, have not yet brought about a normally stable agriculture. But, in

the main, the farmers have done a courageous, thorough, and efficient job in rectifying a bad situation. Readjustment with respect to the proportion of different things produced, however, was by no means the whole solution of the problem, because the general price level of farm products was down in relation to other things and this could not be remedied by changing from the production of one thing to another.

#### DEPARTMENT WORK REORGANIZED

Naturally the work of the Department of Agriculture has been profoundly influenced by this situation. The department has made important changes in its organization. It has developed new services and new lines of research in an effort to hasten the return of agricultural prosperity.

With a steady and rather rapid increase in the scope and importance of the work of the department to a point where it consisted of approximately 20,000 persons, it early appeared that a general reorganization should be brought about for the proper coordination of its main divisions and to promote efficiency and economy. Broadly speaking, the general organization as put into effect provided for the proper coordination and supervision of the three main classes of work, namely, research, extension, and regulatory work. Each division has been placed in charge of a directing head, responsible to the Secretary, who acts as a clearing house for department policies and projects.

The director of scientific work coordinates and supervises all department activities relating to the finding of new scientific facts. The director of extension work has charge of branches active in sending out these new facts and other information to the public. This work is done largely through extension agents in cooperation with agricultural colleges and through separate offices handling motion pictures and exhibits. The director of regulatory work has charge of the administration of over 30 laws which have been placed in the department by Congress for administration. His work is very closely associated with scientific work, as research along scientific lines is necessary in the administration of many laws.

All forces of the department which are engaged in agricultural economic work were merged into the new Bureau of Agricultural Economics and greatly strengthened in order to better serve agriculture during the period of depression and readjustment. A full discussion of this phase of the reorganization scheme will be found later in this report.

The new plan of organization as put into effect greatly increased efficiency and economy in general administration and made possible the needed regrouping of certain phases of work. It made unneces-

sary the States Relations Service as such, and the Office of Cooperative Extension Work was placed under the director of extension work. It did away with the office of director of information and the Division of Publications, as such, and editorial and distribution work was attached to the Secretary's office. The Office of Experiment Stations was attached to the office of the director of scientific work. Work in motion pictures and exhibits was placed in charge of the director of extension work.

Scientific work in home economics was greatly strengthened by creation of the new Bureau of Home Economics. The establishment of this new bureau with a technically trained and experienced woman as chief will enable the department to extend its work in that field and render better service to the workers in the farm home and rural community.

#### ECONOMIC WORK MERGED

Agricultural problems in the readjustment period naturally centered more on prices and markets than on production. Accordingly, the department greatly expanded its economic work. A departmental reorganization effected in 1921 greatly increased the department's ability to provide information to the farmers as a guide in production and marketing. Under this reorganization plan three separate bureaus that formerly handled economic subjects independently were consolidated. These were the Bureau of Markets, the Bureau of Crop Estimates, and the Office of Farm Management and Farm Economics. Congress appropriated money for the creation of the Bureau of Agricultural Economics, and this organization came into existence in 1922 charged with the exercise of all the powers and the performance of all the duties formerly imposed by law on the three separate bureaus. As a result new studies were begun and new helpful services inaugurated. Investigations already under way were broadened and the efficiency of the department as a whole was increased through better coordination of work and closer cooperation of the personnel. Special attention was given to economic research likely to afford a basis for practical recommendations in regard to land tenure, types of farming, and methods of distribution.

Some of the more outstanding consequences of this development, which will be discussed in greater detail later in this report, were improvements in farm products standardization and inspection, inauguration of a shipping point inspection service on fruits and vegetables, establishment of a radio news service, the upbuilding of a grain news service, and increased activities under the United States warehouse act. The crop reporting work of the department was revised and put on a more scientific basis. Machinery for issuing



semiannual intention-to-plant reports based on information obtained from thousands of farmers in all parts of the country was set up and arrangements were made for the periodical publication of "outlook reports," the first of which was issued last spring.

Valuable assistance was given by the department to the Joint Congressional Commission of Agricultural Inquiry which in 1921 made an exhaustive investigation into the state of agriculture and published a report in four volumes, and later to the National Agricultural Conference called by President Harding and held in Washington in January, 1922. Economists and statisticians in the department were called on for information and counsel by both these investigating bodies. Many of the recommendations of the agricultural conference have since been put in effect.

An outstanding recommendation was for better farm credit facilities. This recommendation has now been realized to a considerable extent through the agricultural credits act of 1923. Other recommendations of the conference that have since been carried out were the strengthening of the Federal warehouse act and the Federal farm loan act, the appointment of an agricultural representative on the Federal Reserve Board, the legalization of agricultural cooperation, provision for a five-year agricultural census, increased appropriations for the crop and market reporting services, and increased support for the International Institute of Agriculture at Rome.

Fair consideration of agriculture in the preparation of a permanent tariff bill was urged by the conference. The department assisted in working out the tariff act by supplying a large amount of data and furnishing experts to congressional committees working on tariff matters. The forecasting and outlook reports now made by the department were recommended at the agricultural conference.

Farmers were urged by the conference to reduce their costs of production and marketing as much as possible. Special departmental studies have since been started to indicate how this may be done. In the last few years the department has collected and published more comprehensive cost figures than have heretofore been available.

Another recommendation of the conference that has borne fruit in department activities was that better information should be made available as to foreign market conditions. In the last few years the foreign fact-finding service of the department has undergone the greatest expansion in its history. What is substantially a world-wide news service on agriculture has been developed. Investigators have studied conditions in all countries in Europe and in South America. They have made comprehensive inquiries into the trend of demand in foreign markets. Distribution of this information by telegraph and radio has greatly enhanced its value.

As a result of the investigations of the Joint Commission of Agricultural Inquiry and the National Agricultural Conference, agriculture came to be the most frequently considered subject in Congress. Reports and speeches made on the question fill hundreds of volumes. Never before had agriculture received so much attention. Out of the discussion there came a number of laws relating to agriculture. These laws, however, were in general a treatment of symptoms rather than an actual remedy for the disease from which agriculture was suffering. They did not recognize and attack the root cause of the trouble, namely, the fact that a surplus of agricultural products had been created by artificial stimulation of production, by high prices, and by unusually favorable crop seasons, and that this surplus could not be sold at remunerative prices, while other economic enterprises had so fortified themselves during the war years that they could resist price and wage reductions.

In other words, it was not seen that the need was for exceptional means of dealing with an exceptional situation. Nevertheless, substantial benefit has accrued to agriculture from legislative relief measures enacted by Congress. This is notably true of the tariff, which has been of manifest benefit to spring-wheat growers, wool producers, sugar producers, and to the dairying and livestock industries. Emergency credit measures passed in 1922 helped to relieve the stringent credit situation among the farmers. Appropriations for direct loans to farmers in areas where crops had failed gave needed relief. Congress extended certain debts owed by farmers to the Government and appropriated \$10,000,000 to buy food for Russia. This last action probably had some effect in raising the price of grains. Credit advanced by Government agencies in 1921 and 1922 eased an acute credit situation in the West, and for a time prevented many banks from closing their doors.

Extensions of credit were not, however, in all cases a kindness to farmers and stockmen. Sometimes producers were encouraged to hold on for a year or two only to find they were engaged in a hopeless and losing struggle in which they were finally overcome. In the main, however, the emergency credit provided by the Government did good. It helped to hold down high interest rates and inspired confidence among bankers who were hard pressed and under severe strain.

In 1923 an agricultural credits act of a permanent character was passed from which agriculture has already received important advantages and from which it may expect to benefit more and more as the full intent of the act is realized. This measure was designed to furnish intermediate credit. Intermediate credit is credit running for longer terms than ordinary bank loans but for shorter

terms than mortgage loans. Lack of such credit had been a serious handicap on agriculture. There are many farm operations which need credit running from six months to three years. Such credit had formerly been supplied on the basis of short-term loans usually renewed but subject to withdrawal in any credit emergency. Under the agricultural credits act 12 intermediate-credit banks have been set up to provide financial accommodation for agriculture for terms corresponding to the farm turnover.

Loans by these banks up to October, 1924, totaled more than \$55,000,000. Of this total rediscounts amounted to \$20,000,000 and direct loans to \$35,000,000. In the main the law seems to be working well. It may have to be amended from time to time. Doubtless it will work better as farmers learn how to take advantage of its provisions. A good feature of the measure is the protection it gives farmers against exorbitant interest rates by means of a provision requiring that the rate charged the farmer shall not be more than  $1\frac{1}{2}$  per cent greater than the rate at which the farmer's note is discounted.

Under the Capper-Volstead Act, enacted by Congress on the recommendation of the agricultural conference, legal obstacles to the free organization and proper functioning of farmers' cooperative associations were removed. There is no doubt that this act has assisted the development of agricultural cooperation in the last few years. The packers and stockyards act extended Government supervision over interstate meat packers, public stockyards, livestock commission merchants, and other market agencies. It put an end to many improper practices in the marketing of livestock.

An opportunity was given the Government for the first time under the future trading act to supervise and study the operations of grain exchanges. Already this law has had a wholesome effect. In time systematic studies now being made should enable us to form a reliable opinion as to the value and function of grain exchanges. Heretofore these institutions have been regarded in some quarters as wholly good and in other quarters as wholly bad. These conflicting opinions were not based on adequate knowledge. No one had the necessary information to form a trustworthy opinion as to the merits and demerits of grain exchanges. It is now possible to learn what takes place on grain exchanges, to determine the volume of business done and the relation of that business to the physical volume of crops marketed, and to form an idea of the effect of grain-exchange trading on prices. This study will be completed as soon as possible.

An important phase of the department's economic work in the last few years has been its study of land resources and land-tenure policies. This study has shown the need for a classification of unde-



veloped and underdeveloped lands. Without such a classification it will be difficult to bring about the use of these lands for the purposes to which they are best adapted. It will also be hard to prevent losses to settlers and to the public through attempts to use them for purposes to which they are not adapted.

Much of our agricultural distress has come from misfit land policies and systems of farming. This is particularly true of our great semiarid region where attempts to cultivate small farms on land adapted by climatic conditions to grazing have helped to destroy the range-stock industry and brought little but disaster to the settlers. In this region agriculture should be based primarily on grazing. Our land laws should be revised to promote that end.

Much of our agricultural expansion in the future must take place on lands requiring reclamation either by drainage or irrigation. Department studies have shown that land reclamation projects heretofore undertaken have made much land available for cultivation before there was any need for it. Until there is a greater need for cultivated crops much of the land that it is proposed to reclaim should be left to produce pasture, timber, and game. Additional land reclamation at the present time will merely aggravate the adverse conditions under which our farmers are working. So far as reclamation is subsidized it is subsidized in part at the farmer's own expense.

Useful studies of the relation between land income and land values have been made by the department. These studies have tended to make possible a more correct appraisal of land values. They help to furnish a basis for judgments as to land values for the purposes of purchase or sale and as a basis for loans or for taxation. Other studies by the department have dealt with the problem of tenancy. A considerable amount of tenancy is inevitable. It is therefore important that lease contracts should be fair to both owners and tenants. The department has made a study of prevailing types of tenant agreements and their operation with a view to promoting the use of the better types. Studies of the character of the farm labor supply, the conditions of labor agreements, and the progress of farm laborers have been made in typical districts, for the double purpose of improving the farm labor supply and of helping farm laborers in their advancement toward farm ownership.

#### STATISTICAL WORK STRENGTHENED

Readjustments in our agricultural program made necessary by postwar conditions have strongly emphasized the need for additional statistical and economic information. There has been a great increase in the demand for such information. To meet this demand

the department has expanded its statistical and market news services. Great improvement and advancement have been made in crop and livestock estimating and forecasting. Better statistical methods have been adopted and the number and scope of reports have been practically doubled. Special attention has been given to the gathering of information likely to aid producers in making plans for the future.

In an effort to bring about a more balanced program of planting, a system of reports on farmers' intentions to plant has been developed. "Intention to plant" information, collected in advance of planting and widely published, helps farmers to know whether there is a tendency to overplant or underplant various crops, and enables them to make a better adjustment of their own crops to probable market needs.

These "intention to plant" reports were begun in the spring of 1923. A report was issued on April 20 of that year covering spring-sown crops. Another was issued on August 15 covering wheat and rye. The third was given out in March of 1924, covering spring grains, and still another in August of this year covering the acreage intended to be sown to winter wheat and rye.

From certain sources there has been criticism of these reports. In the case of cotton this criticism was strong enough to bring about legislative prohibition against them. Nevertheless, the "intention to plant" reports are appreciated and used by farmers and extension workers everywhere.

In response to a general demand from all interests connected with the production and marketing of livestock products, the department about three years ago began to collect and publish more complete and timely information as to trends of production and market supplies. Previously the only estimates of livestock production made by the department were the January 1 estimate of animals on farms, the April 1 estimate of brood sows, and the September 1 estimate of stock hogs. No attempt was made to estimate the number of animals on feed or the seasonal movement of market supplies in important producing regions. Little information was available as to the States or regions of origin of livestock supplies. Few States had any dependable information as to seasonal or annual markets for the livestock produced. Information was lacking as to the volume of shipments from important feeding or breeding districts.

These wants have now been fairly well met. Extensive and valuable records have been compiled for the principal livestock States covering livestock movements by months and years since January, 1920. From this information, supplemented by more detailed statistics which will be obtained from the census soon to be taken, it will be possible to make a bookkeeping record of livestock production and

marketing. A fairly complete program of reports dealing with various aspects of livestock production, seasonal market supplies, and probable market movements has been inaugurated.

Among the most important of these reports are those giving the results of the semiannual pig surveys made on the basis of material collected in cooperation with the Post Office Department through rural mail carriers. Five such reports have now been issued. Information obtained from these surveys as to the trend of hog production and market supplies has been remarkably accurate as measured by subsequent records of marketing and slaughter. Since the pig surveys cover not only current production but future breeding intentions, they furnish producers with a guide in determining production plans. The records collected by rural carriers have been enlarged to include information on both dairy cattle and poultry. It is expected this information will make it possible to forecast the number of cows on farms one or two years in advance.

Similar information about cattle and sheep in the 17 western breeding States is furnished in reports covering the calf and lamb crops, and the estimated numbers to be marketed over seasonal periods. In gathering these data the voluntary reports from producers are supplemented with direct inquiries in the field by trained specialists.

Feeding cattle and feeding sheep for market are supplementary farming activities which involve peculiar risks. Accordingly special effort has been given to getting information as to cattle and sheep on feed. Regular estimates are made of the numbers on feed at different dates in the Corn Belt and in other important feeding areas. Special reports are issued dealing with the movement of feeder cattle and sheep into important feeder States and with prevailing conditions affecting feeding activities. In the case of sheep these feeding estimates are followed by weekly reports on car loadings and by monthly estimates of the number still on feed. Crop and livestock reports issued by the department are available not only as a means of effecting a more orderly distribution of supplies, but are the basis of extended studies. Producers' organizations, stockyards companies, railroads, bankers, industrial information services, market reporters, agricultural research workers, and others are making more and more use of the department's information. The basic facts necessary to a better program of livestock production and to effective organized marketing are being accumulated. As this information becomes more complete and experience is gained in its interpretation, it ought to be possible to eliminate many of the ups and downs that heretofore have been the bane of the livestock industry.

In crop reporting, likewise, the department has made greater progress in the last four years than in any previous period. Accu-



rate determination of acreage and of numbers of livestock on farms is essential to any satisfactory system of crop and livestock reporting. Up to four years ago little had been done toward gathering facts from farmers and others on which to base estimates of changes. Since then almost a revolution in statistical methods has taken place in the department's work. The department's statisticians now base their estimates not only on information furnished by thousands of individual farmers as to their own operations but also, in the case of acreage, on field counts and measurements. A crop meter has been invented which is attached to an automobile and records the number of lineal feet in each kind of crop over selected routes. The same routes are measured from year to year, and comparisons are made.

In September of this year nearly 800,000 schedules covering acreage information were sent out through rural-mail carriers to individual farmers. Results of this inquiry will be checked with the complete enumeration to be made in December and January, when the quinquennial census of agriculture is taken. It is proposed to make similar acreage surveys through the rural carriers each year. Closer annual figures on acreage ought to be obtainable by this method.

Research work is going on to develop better methods of forecasting yields. A revision of the estimates of acreage and production of crops and the annual reports of the numbers of livestock on farms is under way. After a careful analysis of all available information back to 1863, when the crop and livestock estimating work was started, the annual estimates will be revised. These revised statistics will be extremely useful.

Practically no crop reports are now issued by any State that do not form part of a unified State-Federal crop reporting system. Last year witnessed the signing up of cooperative crop reporting agreements with the Kansas Board of Agriculture and the Pennsylvania Department of Agriculture. Kansas and Pennsylvania were the only remaining States having a crop reporting system which had not entered into cooperation with this department. The joining of State crop reporting systems with that of the Federal Government has eliminated duplication of work and confusion due to conflicting reports. It has also made it possible to gather much more detailed information than formerly.

#### WAREHOUSE SYSTEM EXPANDED

One of the most important services of the department in the last four years has been its development and expansion of the Federal warehouse system. When the cotton exchanges closed in the summer of 1914, this country had fast maturing the largest cotton crop in its history. The New York Cotton Exchange closed on July 31, 1914.

On that day the December option was quoted at 10.75. Prices declined rapidly thereafter until in October cotton was unofficially quoted at 7 cents. The decline of spot cotton had been still greater. These conditions suggested the need for a system of warehousing and a warehouse receipt which could be made the basis of sound financing of the cotton crop.

Accordingly, within two weeks after the closing of the New York Exchange, a bill authorizing the Secretary of Agriculture to license cotton warehouses was introduced in Congress. Similar bills were introduced shortly after. Finally, on August 11, 1916, the United States warehouse act, applying to cotton, grain, wool, and tobacco became law. By this time the crisis in cotton marketing had practically disappeared.

Hence, little was accomplished under the warehouse law during the first four and a half years after its passage, but the need for it again became urgent with the agricultural depression of 1920-21. In that period of falling prices the department felt that the United States warehouse act ought to relieve the situation by giving farmers a warehouse receipt which bankers would recognize as the best form of warehouse collateral on the market. An investigation was made by the department to see why more warehouses were not federally licensed. It was soon discovered that important bankers were not acquainted with the warehouse law. Efforts were at once made to correct this situation, with the result that warehousemen in increasing numbers sought the advantage of Federal licensing.

The following table, contrasting licensed storage capacity available on April 1, 1921, with the amount available on October 1, 1924, shows the progress made:

Date	Cotton	Grain	Wool	Tobacco	Peanuts
	<i>Bales</i>	<i>Bushels</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Tons</i>
Apr. 1, 1921.....	429, 975	2, 108, 400	24, 375, 000	None.	None.
Oct. 1, 1924.....	2, 639, 996	36, 432, 795	23, 226, 250	551, 696, 000	4, 285

Cotton was the commodity in connection with which the need of improved warehouse collateral was first keenly recognized, and it was the commodity which offered the first demonstration of the value of the new system. During March, 1921, middling cotton on the New Orleans Exchange averaged 11.08 cents. At many interior points middling cotton was offered during the first six months of 1921 at 10 cents and less. Even at such prices it went without a buyer.

About this time cotton growers cooperative marketing associations were coming into existence. In July, 1921, the Mississippi Staple

Cotton Growers' Association asked the War Finance Corporation for a loan of \$7,000,000. As security it offered warehouse receipts issued under the United States warehouse act. After studying the provisions of the warehouse act and the department's regulations and methods of administration, the corporation announced it would grant the loan. Shortly afterwards it made other similar loans. This action not only helped to stabilize the cotton market but promoted an upward trend in cotton prices.

Middling cotton during September averaged 19.35 cents. Ever since that time cotton has been considerably above the low prices of the depression period. While, of course, the warehouse act and the financing done under it have not been the sole cause of this advance, they have favorably influenced the cotton market.

In the last two years 11 of the 13 cotton growers' cooperative associations operating on a State-wide basis have stored all their cotton in Federally licensed warehouses. Many leading cotton dealers and thousands of individual farmers who do not belong to growers' cooperative associations are also using the licensed warehouses. On other products also the act has had a marked influence. Millions of pounds of wool are shipped annually by farmers to large Federally licensed wool warehouses in San Francisco, Portland, Oreg., and Chicago. The tobacco produced by thousands of farmers in the growers' cooperative associations of the Carolinas, Kentucky, and Wisconsin is stored in Federally licensed warehouses.

Warehouse receipts issued under the act are coming more and more to be recognized by bankers as the best form of security for loans on agricultural products. This is evidenced by the action of the St. Louis Federal Reserve Bank, which on July 16 last adopted a resolution declaring that the "bank and its branches will not accept as collateral warehouse receipts for agricultural products as covered under the United States warehouse act, unless such receipts are issued by a warehouse duly licensed under that act."

The act has enabled farmers individually, as well as through cooperative associations, to get loans on their products in larger amounts and at lower rates of interest. Sections where the banks had no money to loan have been relieved by farmers presenting Federal warehouse receipts to local banks, who in turn could pass along the paper either to their correspondent banks in some large city or to Federal reserve banks. All the leading banks in New York recognize the value of Federal warehouse receipts. Many of them have loaned millions of dollars to producers on such receipts. The intermediate credit banks established under the agricultural credits act of 1923 have all indicated that they prefer Federal warehouse receipts. While it is not possible to give the exact amount that has been loaned on Federal warehouse receipts, the total certainly exceeds \$500,000,000



since 1921. Recently large amounts have been loaned on this collateral at interest rates as low as  $4\frac{3}{8}$  per cent.

Originally the law applied only to cotton, grain, wool, and tobacco. It was amended, at the request of the department, last February so as to give the Secretary of Agriculture authority to place under the law such products as he might consider properly storable. Since then peanuts, potatoes, broom corn, and dry edible beans have been made eligible for storing under the warehouse law. In the near future the provisions of the law will be extended to dried fruits and nuts. With the principal financial institutions of the country recognizing the superiority of Federal warehouse receipts as collateral for loans, farmers, shippers and dealers should no longer have any difficulty in obtaining the credit necessary for orderly marketing.

#### MARKET NEWS SERVICE

Growers of fruits and vegetables felt the agricultural depression less severely than grain and livestock farmers. Severe spring freezes greatly reduced the fruit crop of 1921 throughout most of the area east of the Rocky Mountains and north of the Gulf States. The production of vegetables that year was not excessive so that relatively higher prices were realized for the perishables than for other crops. The potato crop is generally conceded to have given the farmers of the central Northwest practically the only profits of the season.

These conditions tended to stimulate truck-crop production in the following year, while at the same time the fruit crop was generally good throughout the country. Beginning with that season the volume of production has been such that market prices have generally remained close to, and often below, the cost of production. This condition has been aggravated as to fruits by the coming into bearing of large orchards started during the era of high prices. Many of these were speculative plantings based upon the earlier success of relatively small orchards or groves.

The steady pressure of supplies upon the consuming capacity of the country has emphasized anew problems which had been felt before the war. Accordingly Congress, in the midst of a retrenchment program, nearly doubled the appropriation for the collection and distribution of market news, enabling the department to reestablish its leased wire system to the Pacific coast and Florida, and to increase somewhat its number of permanent stations and its field force, which serves in turn the areas of heaviest production. Every agency has been utilized for the general distribution of this information, including not only the metropolitan and local press but to an increasing degree the radio, telegraph, and telephone. In addition some 65,000 to 70,000 individuals most vitally concerned in the ship-

ment and handling of perishables receive daily direct communications from our numerous branch offices and field stations. Never before has statistical and market information on our perishable crops been so easily and constantly available to so large a proportion of those interested. As a result prices generally have risen and fallen in large and small markets alike throughout the greater portion of the country.

#### NEW MARKET GRADES ANNOUNCED

Increased production has brought with it other problems. Faced with a potential oversupply and the certainty in many cases that the movement of the entire crop would inevitably lead to disastrous results, the grower has been compelled to cater to the demand of the market as never before and to discriminate closely between grades which could be marketed at a profit and those which could not. This has emphasized the need of the systematic and uniform grading of the produce from different regions which compete in the consuming centers. In 1921 the department had recommended market grades and standards for 13 of the principal perishables.

During the last three years investigation in this field has been pressed to such a point that we now have well recognized national grades for more than 30 of these products. The use of the grades is not compulsory, but they have so met the conditions of production, the needs of the trade, and the demands of the consumer that they have come into very rapid and general use. In many States they have been given official sanction, and in several States the force of law. Cooperative associations have made possible a large part of the progress of the standardization program. Through them has come a determined effort to sell more largely at shipping points and to reduce so far as possible the volume of consigned goods.

#### INSPECTION SERVICE POPULAR

The need for a disinterested inspection service was increasingly felt as standardization programs progressed. The inspection service rendered by this department at terminal markets was useful in the settlement of disputes, but was not a preventive. Congress, in the spring of 1922, authorized the department to begin a system of inspection for grade and quality of fruits and vegetables which should be available at the shipping points, as well as in the markets, provided only that the volume of business be such that the fees voluntarily paid therefor should approximate the cost of the service. This has made possible a practical application in the field of a comprehensive standardization program. The demand for this service from the day of its inception has exceeded the resources of the department.

The work has been carried on by cooperation with the States. Congressional appropriations have represented only the cost of supervision, which has been returned to the United States Treasury practically in full.

Tens of thousands of carloads of fruits and vegetables conforming to specific grades are now sold f. o. b. loading point to distant buyers at an agreed price, under Government inspection, and with a copy of the certificate mailed with the bill of lading when desired. Seventy-three thousand cars were thus inspected during the fiscal year 1923, 128,000 cars in 1924. A further increase is in prospect for the current year.

A spectacular development following the introduction of this service was the organization of two marketing agencies known as f. o. b. auction companies, whose sales rooms in numerous cities are connected by leased telegraph lines. Here simultaneous auctions are conducted of carloads of fruits and vegetables loaded the day before and still often thousands of miles away. Competitive bids between cities are made over the wire and cars are auctioned at the rate of about one a minute. The business of a single company is sometimes over 200 cars per day. In these auctions buyers are guided entirely with respect to the kind and quality of the product by the summaries of the inspector's certificates which have been wired to the auction company and printed in the form of a catalogue of offerings. There are no samples shown at these auctions, the auctioneer and buyers being entirely dependent upon the ability and disinterestedness of our inspectors.

Fruit and vegetable shipments have largely increased in the last four years. Grape shipments have almost doubled, largely from California. Celery shipments have increased about 80 per cent, grapefruit 58 per cent, and many other products only slightly less. This has resulted in such a pressure upon the market that in spite of all aids in making f. o. b. sales a tremendous volume of perishables has moved to markets on open consignment for sale on commission. Returns have necessarily been disappointing in many cases and uniformly low throughout the greater part of the shipping season of most commodities. The grower realizes the disadvantage of his position in that he has no voice in the final sale of this produce, nor has he in most cases any assurance that his goods have been handled to the best advantage or that his returns are accurate and complete. The laws governing contracts and defining the duties of agents afford no adequate protection in transactions of this character.

Shipments can now be made under Government certification as to quality and condition, the grower thus surrendering the right to make representation as to the character of his goods. His agent, however, disposes of the goods in the markets at his own pleasure and none



may know whether his returns represent the price actually received for the individual shipments, the average price of his sales for the day, or the price which conforms to the general market level influenced largely by goods of inferior quality. Proposals looking toward the correction of these conditions have been approved by the department and are now before both Houses of Congress.

A problem of first importance in the fruit and vegetable industry has arisen out of the practice of buyers who purchase their supplies at the point of production but who, upon the arrival of the shipments at destination, refuse to accept and pay for them at the agreed contract price. Shippers contend that the rejection of their shipments usually occurs during market slumps, and that the grounds for rejection in such periods are often highly technical. Receivers declare that their general practice is to accept shipments as long as they can do so without sustaining losses, but that in periods of market depression good judgment dictates the rejection of shipments which fail to comply with contract terms. A study of this problem was made by the department covering the distribution in 1922-23 of more than 10,000 carloads of boxed apples, or well over one-third of the crop of the State of Washington.

It seems that a remedy for excessive rejections must be sought by reforms at both ends of the line. One year's study brought out the astounding fact that although boxed apples are a highly standardized crop moving through well-established trade channels, one car in seven became the subject for adjustment. Though the produce trade has attempted to settle its own disputes by arbitration, there has been a practical breakdown of available arbitration machinery. Recourse to the courts has been impracticable because of the cost and delay of court proceedings. There is need for official agencies which can not only adjudicate disputes between buyers and sellers on the basis of established trading rules, but which can assure growers of prompt and accurate accounting for shipments forwarded to city receivers on consignment.

Substantial service was given by the department to the Georgia peach growers in marketing their 1924 crop. This operation presented one of the most difficult problems ever faced by growers and shippers in this section. Early estimates indicated a possible movement of around 15,000 cars. The probability was that 10,000 cars would move within five weeks. The simultaneous movement of over 17,000 cars of California cantaloupes and 10,000 cars of southern watermelons complicated the task. It was evident that as many cars as possible would have to be shipped to small markets so as to avoid glutting large ones. A survey of available markets for carloads of peaches was made by the department. Information given

by this survey, with daily telegraphic reports of shipments and market conditions, formed the basis of the daily distribution of unsold cars of peaches moving to market. This distribution was handled by the department's representatives and by representatives of the Georgia peach-growers exchange and other shippers.

By this means smaller markets were utilized much more than in former years. Thus up to August 16 only 3,086 cars of peaches were unloaded in New York City compared with 3,233 unloaded there in 1921, when shipments were 3,000 cars lighter. New York received but 23 per cent of the carload shipments in 1924, compared with 30 per cent in 1921. Receipts in Philadelphia and Chicago were similarly reduced. In general, the movement to western markets was heavier and that to eastern markets lighter. Thirteen of the large markets received only 56.2 per cent of the 1924 crop, compared with 64.3 per cent of the 1921 crop. It is certain that the efforts of the department to effect a wide distribution of the Georgia peach crop yielded substantial returns. While prices received by growers for a considerable portion of the season were not satisfactory, they would have been less satisfactory still had the crop been concentrated in a few large markets. A tremendous volume of peaches, approximately 13,500 cars, was shipped from Georgia this year. Approximately 75 per cent of the total moved to market in July. This is an unprecedented movement of a highly perishable crop in such a short time. It could not have been accomplished without much heavier losses had the distribution not been considerably broader than usual.

#### EGG STANDARDS FAVORED

The department is undertaking a program of egg standardization. After a careful study of existing egg grades and of the various factors affecting egg quality, and with the cooperation of representatives of farmer organizations and others interested in the egg industry, two sets of uniform grades for eggs have been proposed. One is designed for use in wholesale channels of trade and is known as the United States wholesale grades. The other, a simpler set of grades, is known as the United States buying grades and is designed for use in buying eggs from producers at country points. These grades offer a practical basis on which eggs can be purchased and sold and by means of which better prices can be paid to producers of the higher qualities.

To acquaint farmers with these grades the department has distributed thousands of circulars emphasizing the importance and advantages of their use. Extension services in more than 20 States are helping to bring the egg standardization program to the attention of farmers. Egg-inspection services have been established at

New York and Chicago, where department egg inspectors are available to examine and report upon the condition and quality of egg shipments.

#### GRAIN GRADES AID FARMERS

Grain growers have benefited materially in the last few years from modifications, improvements, and extensions that have been made in the Federal grain-grading system. It is difficult to measure this benefit, but it is undoubtedly substantial. Federal grain standardization, by establishing a uniform basis for interstate trading, lessens the chances for misunderstandings and disputes, gives confidence to buyers and sellers, and facilitates business at every stage in the movement of grain from the farm to consuming centers. It thus tends to reduce distribution costs. Reduction of distribution costs is of practical value to the farmer at any time. It is especially useful to him in times of low prices, when inefficient distribution may saddle him with an intolerable burden of expense.

It may therefore be fairly claimed that the Federal grain-grading system, though in effect before the depression period started and thus not in any sense an emergency relief measure, has been a valuable help to the farmer in his effort to deal with the problems of the readjustment process. The inspection service, which serves to insure uniform application of the Federal grades, does not, it is true, reach all country shipping points. Yet farmers delivering grain at country points are not on that account shut out from its benefits. The Federal grain-grading system enables business to be done on smaller margins than would be necessary were country buyers forced to take their chances in a market lacking definite universally recognized standards of quality. Under chaotic grading conditions the risks of the country grain buyer would be greater than they are to-day and would naturally be reflected in the prices paid to producers.

It is generally conceded that the exportable surplus of grain in this country practically establishes the price paid for the entire crop. American grain during the first decade of this century fell into disrepute in Europe. This was not because the grain had deteriorated but was due to confusion created by the many systems of grading then existing in the United States. Prior to the passage of the United States grain standards act in 1916, grades in this country were established in the various States where State laws on the subject existed, and by commercial exchanges in States that had no grain grading laws.

In this situation dissatisfaction arose from an unavoidable lack of uniform application of grades. Federal grain grading, by removing this source of trouble, benefits the farmer, the country grain buyer, the elevator operator, the grain broker, the commission man, the



shipper, the exporter, the foreign buyer—in short, everybody interested in the grain trade.

In the last three years protein in wheat has played an increasingly important part in the merchandising of the commodity. Bakers have taken to demanding flour of certain definite protein content in the belief that with flour of standard strength of protein content more uniform and satisfactory bread can be made. Millers therefore buy wheat largely on the basis of its protein content as well as on the basis of its commercial grade. To determine the protein content of wheat necessitates the use of a highly technical chemical method and much costly apparatus. Requests have been made to the department for the incorporation of protein as a factor in Federal wheat grades, but the department does not believe this should be done. Country buyers could not determine the amount of protein in wheat offered by individual farmers for sale, and consequently could not reflect terminal market prices to farmers on a protein basis.

Nevertheless, the department in establishing Federal wheat grades has not been unmindful of the importance of protein. It has divided the various classes of wheat into subclasses, and the subclasses are then divided into numerical grades. The division of the classes into subclasses is based on content of "hard, vitreous" kernels. Such kernels are higher in protein content than kernels which are soft and starchy. Wheat experts are able to judge the protein strength of wheat from the hardness and vitreosity of the kernels. That this index, which is incorporated in the Federal grades, furnishes in a general way a true measure of the protein content of wheat is borne out by the fact that wheat falling into the subclass "dark northern spring" brings several cents a bushel more on the market than does wheat falling into the subclass "northern spring."

Wheat arriving from country points at Minneapolis and Duluth shows upon inspection and grading thereof that an enormous quantity of weed seeds and other foreign material is marketed along with the wheat. Millers can not grind such wheat into flour without first removing the foreign material. The cost of this cleaning operation is reflected back to the farmer through the price paid at terminals. Clean wheat will always bring more money than wheat which is not clean. The department has observed this situation in the central Northwest in connection with its supervisory activities over the inspection and grading of grain received at the Northwest terminal markets, Minneapolis and Duluth.

About 96 per cent of the spring wheat farmers in 1922 sowed from one thousand to half a million weed seeds per acre with their wheat. Nearly 12,000,000 bushels of screenings (weed seeds and foreign material other than wheat, commonly known as dockage) were produced in 1923 by spring wheat farmers in North Dakota,

South Dakota, Minnesota, and Montana. Over \$675,000 was paid for threshing this "dockage." Over 13,890 extra freight cars were used to haul it to market. This made the car shortage more acute. Over \$800,000 freight was paid for transporting this dockage. More than 3,500,000 lambs could have been fed on these farms with the wheat screenings which the farmers of these four wheat States shipped with their wheat and for which they not only did not receive any pay, but in the case of certain classes of dockage received a lower price for their wheat because of its presence. Screenings can be cleaned out of wheat and rye at the time of threshing or at the farm granaries at a cost of 2 or 3 cents per bushel.

Records of this department show that spring-wheat farmers who did clean their market wheat on the farm in 1923 gained over 5 cents per bushel as a result of the cleaning. As a result of the department's observations and studies a successful type of machine for cleaning grain at the threshing machine as a part of the threshing operation has been perfected. This is a portable cleaner especially designed for the cleaning of spring wheat and rye. It is mounted on a truck on which are also mounted a gas engine and two conveyors.

This cleaner has been tried out in connection with threshing machines operating at various points in South Dakota, North Dakota, and Minnesota. In operation the cleaner cleaned the grain as fast as it was threshed and delivered the clean grain into one wagon box, the wild oats into a second wagon box, and the fine seeds into sacks. Sixteen lots of grain containing from 3 to 24 per cent of dockage were cleaned to a dockage-free basis. In one lot of wheat containing as high as 15 per cent of dockage the dockage was reduced to 1 per cent. The results of such cleaning tests conducted by the department have been entirely successful. The type of cleaner referred to is being manufactured in a commercial way and put on the market.

#### GRAIN MARKET SERVICE

Lack of comprehensive information as to the real factors which go into the grain market has seriously added to the difficulty of the farmers' marketing problem. Much information has long been available through trade channels to dealers in grain, but these data have not been available to farmers. Newspapers and farm periodicals have carried reports. Such reports, however, have not given the farmer the right basis for an intelligent study of the market. About a year ago a new grain market news service was incorporated by the department to convey market information promptly to farmers. This service is now reaching approximately four and one-half million farmers through the daily papers, the weekly and monthly farm press. In the spring-wheat territory about 50 publications are using the market news service. In the

winter-wheat territory more than 100 daily and farm papers are using it. It is hoped that before long at least one paper in each leading agricultural county in the United States will be publishing the department's weekly grain market releases.

These reviews are forwarded by leased wire to branch offices in Minneapolis, Chicago, and Kansas City. They are mailed out from those cities to local points. Foreign crop and market information, as well as domestic news, is included in the reviews. Contacts have been established with market agencies in the important grain markets east of the Rocky Mountains, and comprehensive reviews describing the local grain-market situation are obtained regularly from them each Friday by wire.

#### FEED PRICES ARE STUDIED

Feedstuffs represent, next to labor, the largest item of expense in the farmer's budget. The national feed bill totals several hundred million dollars annually. More efficient purchasing of feed would put millions of dollars in the farmers' pockets. To assist farmers in making their feed purchases on the best possible terms, the department since 1920 has issued detailed reports covering the market situation of the more important feedstuffs. These reports, supplemented by price tables, appear weekly in a department publication known as Crops and Markets. They unquestionably help to stabilize feed prices.

It was thought, however, that better results could be obtained by getting market information to farmers as soon as possible after the close of markets. Accordingly the department sought to interest State marketing departments in a plan whereby the Federal department furnishes all the necessary material for a comprehensive review of the feed situation, including delivery prices for feedstuffs for the most important points. Reports under this plan are transmitted over the private wire service of the Federal department. They are printed or mimeographed by the State organizations for distribution to interested persons. New Jersey was the first State to act on the cooperative arrangement. The report was an instant success. Originally published as a weekly, it is now issued triweekly. Soon afterward the State marketing agencies in New York and Pennsylvania and New England States made arrangements to issue a similar report covering the feedstuffs situation in their States.

A branch office was established to comply with an urgent demand for similar reports covering Wisconsin, Minnesota, Michigan, Iowa, and Nebraska. These States are served from Minneapolis. Consumers as well as producers can take advantage of the cooperative Federal-State market reporting service on feedstuffs. Formerly, it was not an uncommon occurrence for feed buyers to pay excessive



prices. Publication of delivered prices, representing the basic cost of feedstuffs at mills, plus freight charges to destinations, makes it possible for them to determine at a glance whether the quotations made to them are reasonable.

Though hay is usually the second agricultural crop of the United States in farm value, it has received less attention in regard to standardization and marketing methods than other major crops. Until recent years, no concerted efforts had been made by Federal and State organizations to improve hay marketing methods. As a result the national trade in hay was in a chaotic condition.

An important step toward correcting this trouble was taken when the Department of Agriculture published and recommended United States grades for timothy and clover on February 1, 1924. This action followed public hearings held from time to time since 1922. At these hearings proposed grades for timothy and clover hay were submitted to representatives of producing and distributing interests. These grades were the outcome of investigations started in 1920, in the course of which thousands of samples of baled hay were assembled from many markets and shipping points. The investigations revealed simple grading factors by which it is possible to grade hay by approximately uniform methods.

Following the recommendation of timothy and clover grades, a demand arose in the Western, Northwestern, Southwestern, and Southern States for grades for alfalfa, wild hay, and Johnson grass hay. Studies are being made looking toward the establishment of standards for these kinds of hay.

The department in 1922 organized a hay-inspection service. Inspectors were licensed under cooperative agreements with States, trade organizations, and shippers' associations. At present the inspection service has 10 market inspectors located at Boston, New York, Philadelphia, Washington, Richmond, Va., Norfolk, Va., Birmingham, Ala., Cleveland, Chicago, and Kansas City. There are 11 shipping-point inspectors with headquarters at Augusta, Me., Auburn, N. Y., Trenton, N. J., College Park, Md., Richmond, Va., Raleigh, N. C., and Madison, Wis. When the new grades now under consideration are promulgated many hay markets in the East and South will undoubtedly desire inspection service.

#### REPORTS ON FOREIGN SEED

Our farmers wish to buy dependable seeds as cheaply as possible and sell their surplus of other seeds to the best buyers. This means buying some seeds in Europe and selling other kinds to Europe. Accordingly the department has started services, in connection with reports issued covering conditions in the United States, that will keep the farmers informed as to seed production, seed movement,

and seed prices in European countries. This information enhances the value of reports covering the domestic supply of and demand for seeds: The seed business is an international one. Information for the United States alone is therefore not a reliable index of market trends. Thus in 1923 the crop of red clover seed in the United States was only about half as much as in 1922. Yet prices for red clover in the spring of 1924 were only a little higher than during the preceding year. This was because Europe had produced a large crop in 1923. Information as to such facts obviously is of great value to the farmer.

Arrangements have been made by the department to get monthly reports from the correspondents of practically all the leading seed markets of Europe. These reports will show where surpluses of seed exist, what districts produce the best seed, when seeds are ready to export to this country, and what countries are the chief competitors of the United States in the purchase or sale of seed. Since the war a number of countries have been exporting seed to the United States direct instead of through Germany. Seed movements to this country, however, are still more roundabout than they need be. Seed studies started by the department should help to shorten the movement.

#### STUDY OF COOPERATIVES MADE

Research and service activities relating to cooperative marketing have been maintained by the department since 1913. In the last four years, this work has been greatly expanded. A period of rapid development in cooperation began about 1920, as a result of which the volume of business transacted by cooperative organizations approximately doubled. In an effort to help in placing this development on a sound basis the department decided to make a study of the conditions making for success or failure. As a first step, existing organizations were surveyed. Information has now been collected and tabulated regarding more than 10,500 farmers' cooperative organizations. This collection of information forms a source library on cooperation in the United States. It is a basis for detailed studies of particular organizations and for the investigation of operating problems. Economic analyses have been made of particular problems and of particular commodities.

Advantages of such studies are illustrated by the experience of the maple-sap producers of Vermont. Maple-sap products sank to low prices in 1921. Accordingly the producers sought relief through cooperation. An elaborate plan, involving large expenditure, was drawn up. Before adopting this plan the producers decided to ask the department for help in determining the basic facts affecting the marketing of their products. The department suggested a survey in

which the department and the State college of agriculture cooperated. This survey showed that the demand for pure maple products was less active than had been supposed. Cane, corn, and blended sirups had preempted the retail market. A large part of the maple sirup and sugar produced was sold to tobacco manufacturers, through dealers possessing facilities to put the product in the form required for this purpose.

Conditions revealed by the survey, in short, indicated the necessity of caution. It was the object of the producers to reestablish the market for pure sirup and sugar. But the quantity of products an inexperienced organization could profitably market was limited. Accordingly the Vermont association handled only 15,000 gallons of sirup in 1922. It was able to handle this quantity at satisfactory prices. In the following year it succeeded in disposing of 25,000 gallons and this year 50,000 gallons.

This experience can be usefully contrasted with that of another maple-sap products cooperative organization, which was organized at the same time in another State. This concern went ahead without a preliminary analysis of its marketing problems. It received over 100,000 gallons in its first year. This quantity proved to be more than the available machinery could handle. As a result, dissatisfaction arose from low prices and high costs of organization and operation, so that the receipts of the association declined to 50,000 gallons in 1923 and 20,000 gallons in 1924. These two cases show how important it is to have a careful preliminary analysis of conditions before launching into a cooperative enterprise.

Cooperative marketing is a logical development in the rural economy of a nation. The pioneer farmer to a large extent is self-supporting. As markets become larger and farther removed from the producers, the farmer has to depend on middlemen to transfer his products to the consumer. Cooperative marketing may be described as an effort on the part of the producer to recapture the understanding and control of the marketing process which his forefathers possessed. Perhaps the best example of the part cooperation may play in the development of an agricultural industry is furnished by the cooperative marketing of citrus fruits in California.

When California citrus growers first organized in 1893 the industry was extremely depressed. Prices received during the previous three years had as a rule been less than production costs. Packing and marketing charges were high. Shipments often arrived in eastern markets badly damaged. In the season of 1892-93 the marketing agencies employed by the growers failed to find a profitable market for that season's crop, when the total shipments were only 5,936 cars.



Cooperative marketing brought about an improved distribution of crops and better returns to the growers. Packing charges were reduced at least 10 cents a box. There was an equal reduction of marketing costs. Later there developed improved production, due largely to better control of insect and fungous pests. Through their marketing and affiliated organizations the growers undertook the cooperative purchase of supplies. Handling and grading of the fruit was improved. Modern packing and precooling plants were developed. Demand for citrus fruit was stimulated through advertising. So striking were the results obtained that in 1922-23, out of approximately 60,000 cars of citrus fruit shipped from California, over 80 per cent was marketed cooperatively. The beneficent result of the better system of marketing is shown by the fact that a satisfactory market was found for the entire crop of 1922-23 when the total shipments were 59,707 carloads, which is ten times as large as the shipment of 20 years before.

Studies have been made by the department of the legal phases of cooperation and of its financial aspects. General problems involved in the cooperative marketing of fruits and vegetables have been investigated. Problems and experience of cooperative organizations in foreign countries have been studied and made the subject of department bulletins. Cooperative associations have been advised by representatives of the department in regard to details of organization, accounting, financing, and marketing. Officials of cooperative organizations have got into the way of discussing their problems freely with department representatives.

Good, sound growth in the cooperative movement has been somewhat retarded in recent years by overenthusiastic persons who have held it up as a panacea for all the ills from which the farmers are suffering. The mere organization of a cooperative association is not the end to be attained. It is only the beginning. Success in cooperation depends on finding men capable of running cooperative associations, on the loyal support of the membership, and on getting a sufficient volume of business. Some converts to the cooperative movement urge that the Government should proceed to organize the farmers in cooperative associations. But if the Government should ask farmers to join some particular cooperative association it would put itself in the position of guaranteeing an enterprise without having an authoritative voice in its management. There is confusion in the minds of promoters of cooperative enterprises as to what the Government may properly do.

Bills have been introduced in Congress in the last two years which would put the Government squarely into the business of promoting cooperative associations. These bills would set up a great Federal

overhead agency and secondary boards of control and would have these bodies assume control of a number of highly important activities such as the dissemination of market news, a service which is already carried on efficiently by the Federal Department of Agriculture and which in the interest of the farmers should be kept in the control of a well-organized impartial permanent Government department devoted to the service of agriculture and free from entangling business alliances.

The relationship of the Government to cooperation should be one of service. It should help the farmers market their crops just as it helps them to produce crops not by doing the work but by supplying information which the farmers can not get for themselves. To go further would be to injure rather than aid the cooperative movement. The need for strong cooperative marketing associations can not be overemphasized. They are absolutely necessary to bring about efficient and economical marketing and standardization of crops, but the movement should be truly cooperative. It should be controlled by its membership and kept free from domination of Government agencies or commercial interests.

#### PRICE SPREAD INVESTIGATED

Investigations have been made in the last few years by the department into the vitally important subject of the spread between the prices which the producer of agricultural products receives and the prices paid by the consumer. This subject has come into great prominence since the war largely because the spread between the producers' and consumers' prices has increased in the last decade. In the case of a number of important agricultural products the spread between the price received by the producer and the price paid by the consumer is roughly known. But the proportion of the spread absorbed by each step in the marketing process is little known. Hence much of the discussion which is taking place in the press on the subject has been founded on unreliable data.

Only fragmentary data regarding price spreads are available for periods even as recent as 1913-14. Studies on increases in the spread since that time therefore involve considerable difficulty. Results are necessarily only approximate and at the best can only measure a somewhat hypothetical case, in which some assumptions are made as to the grade of the commodity and the marketing channel through which it has passed. Such studies as the department has made along this line indicate that the net profit taken by distributing agencies is insignificant when considered as part of the total spread. It rarely runs over 5 per cent of the consumer's price. Generally it is much less than 5 per cent. The cost of furnishing distributing services is the vital thing. This cost comes to about 95 per cent of the spread.

Efforts have been made by the department to ascertain what portion of the retail price accrues to each agency in the marketing chain in the case of bread, milk, potatoes, and apples. An interesting revelation is the fact that flour as a part of the cost of making bread is becoming less important. It is being overshadowed by the cost of labor and of power for operating machinery, and to some extent by the cost of other ingredients in bread. Thus the cost of other ingredients has doubled since 1913 and bakery labor has increased 43 per cent since that time. Since these other costs are relatively larger than the cost of flour in commercial bread making, changes in the price of bread can hardly be expected exactly to follow changes in the price of flour and wheat.

Service costs in the preparation and distribution of feed products, the department has found, have become such an important item that they outweigh commodity values. Consumers' prices are more affected by fluctuations in service costs than by fluctuations in the farm value of agricultural products. Service costs are therefore the important point of attack in any study of price spreads. These costs are affected by the efficiency of the methods used in handling commodities, by the business environment in which the particular distributing process is done and by the adequacy of the facilities used. It is figured, for example, that about 25 per cent of the trucking charge for handling fruits and vegetables in New York City is due to idle time occasioned by the use of out-of-date facilities. Again, in the retail meat business it seems to be true that a population of less than 1,000 persons for each store tends to a condition where store owners lose money.

#### FARM MANAGEMENT STUDIES OF VALUE

Farm management studies have been of particular value to agriculture in the last few years, because the most urgent agricultural problem was the readjustment of crops to meet the changed world market situation. Every effort has been exerted by the department to make its farm management investigations practical. Thus it has analyzed conditions around growing cities to find out how far advantage is taken of local markets. It was discovered in the vicinity of Altoona, Pa., for example, that a good share of the potatoes shipped in from Boston points could be grown locally to advantage. Surveys on farms in the semiarid spring wheat region have furnished a basis for recommending crop readjustments. Detailed studies of dairying methods have disclosed causes of high production costs, and pointed the way to more economical milk production.

Work done in a particular area will illustrate the character of the department's farm-management studies. In 1923 a survey



was made of 400 farms in Chester County in southeastern Pennsylvania. In this area dairying is the keystone enterprise. Under the price conditions then prevailing, profitable farming was directly dependent on economical milk production. It was shown by the study that some men in the county were feeding two and even three times as much feed for each pound of milk produced as the most efficient producers.

Ways by which farmers in the county could reduce their costs of milk production, as shown by an analysis of their own farm records, were pointed out in a special report. This report showed that much of the difference in efficiency was due to things wholly within the farmers' control, such as the quantity and quality of feed given and the grades of the cattle. County agents throughout the dairying regions of Pennsylvania used the report, which thus was of value throughout an area considerably wider than that covered by the study. Later investigations will show whether farm practices in Chester County have been modified usefully.

#### FOREIGN SERVICE WORK

The foreign service of the department is intimately bound up with its work as a whole. Successful farming means just as much successful marketing as successful production. Hence the farmer is vitally interested in everything influencing the foreign demand for his products. Since the principal outlet for the exportable surplus of our agricultural commodities is Europe, the department has built up a large organization to assemble information about the conditions our farmers have to meet in the European market. It also keeps in touch with agricultural production in the principal food-exporting countries.

The department has 154 employees in Alaska and our insular possessions and 82 in foreign countries outside American jurisdiction. Most of these representatives of the department study the physical and biological problems of agriculture. Experiment stations are maintained in Alaska, Hawaii, the Philippine Islands, the Virgin Islands, and Porto Rico, where scientists study problems of soil and climate and animal and plant diseases. Scientific workers search the world for new varieties of plants. They seek new methods of breeding and cultivation, and new methods of combating diseases and pests. They protect the interests of the American farmer in a great variety of ways. Investigations are now under way regarding potato varieties in Canada, plant diseases in Europe, rubber production in South America and tropical North America, forage grasses in Cuba, cotton and corn in Mexico, plant geography in Europe, cereal rust in India, Egypt, and the Orient, citrus-fruit culture in Japan, plant and seed introduction in Algeria, China, and

Egypt, corn in Brazil and Argentina, forest pathology in Great Britain, and many other matters of concern to agriculture.

Another group of department workers in foreign countries has to do with the business operations of agriculture. These men investigate market conditions in countries that absorb our surplus cotton, wheat, and meat. They gather information regarding available supplies, crop acreage and production, demand and economic conditions generally in foreign countries. They also promote our foreign trade in agricultural products by the administration of grades and standards, by developing new standards, and by fostering better trade relationships between foreign consumers and American producers. The department's economic work in Europe is under the direction of an assistant chief of the Bureau of Agricultural Economics who is stationed at Berlin. General administration of the work is conducted from London and Berlin. From London an agricultural commissioner surveys the situation in Great Britain, France, and Spain. Another commissioner at Berlin looks after the work in Germany, Poland, Scandinavia, Holland, and Belgium. A former employee of the department is the permanent delegate at Rome of the International Institute of Agriculture. He cooperates with the department. Although technically an organ of the Department of State, the International Institute of Agriculture serves as an arm of the Department of Agriculture.

Offices also are maintained at Vienna, where economists and statisticians watch the development of agriculture in the Danube Basin and in southern Russia. Another office at Marseille, France, maintains a research laboratory for combating insect pests. Men handling economic work are also attached to the Marseille office. A commissioner of agriculture at Buenos Aires has charge of investigations into South American competition in cereals, animal products, and fruits. Many laws exist directing the department to investigate and expand foreign markets for American agricultural products. The first of these laws was passed in 1883. In 1914 Congress established in the department an office of markets to foster general marketing and distribution of farm products, and in 1921 the department was authorized and given funds "to collect and disseminate to American producers, importers, exporters, and other interested persons information relative to the world supply of and need for American agricultural products \* \* \*."

In building up its foreign service to comply with this provision of Congress, the department has cooperated with the Department of State. A center of the cooperative service is the International Institute of Agriculture at Rome. Through this institute information is collected by wire and mail from all the leading crop producing and consuming countries of the world. Nearly a third of the foreign

information received by the department comes through the institute. Four hundred consuls of the State Department scattered over the world collect information not covered by the work of the International Institute. About 21 per cent of the department's foreign information originates with the consuls. Altogether, therefore, a full half of the foreign investigational and reporting work of the department is done through its affiliation with the Department of State. The department has also entered into reciprocal arrangements with foreign ministers of agriculture and with other organizations abroad for the exchange of economic information. About 10 per cent of its foreign data comes from these sources. Nearly an equal amount of valuable information concerning agriculture abroad comes from the commercial attachés of the Department of Commerce.

During the last four years an agricultural commissioner in London has reported on market conditions in the United Kingdom, the most important market for American farm products. A specialist in marketing meats was sent to the United Kingdom in February, 1922, to make a survey of conditions affecting the British demand for our pork and lard. This survey was extended to methods of production and marketing in Denmark and Scandinavian countries, which compete with the United States in the British market. Later an agricultural commissioner was sent to Germany, the second most important market for our farm products.

The opening of the British market to American fresh pork has been accomplished by the department. Before the spring of 1922 Great Britain excluded American fresh pork, but since that time has admitted it under certification by our Government that the pork has been handled in the manner prescribed by British authorities. Since this arrangement British imports of both fresh and frozen pork have largely increased. In 1922 Germany was persuaded to allow the importation of several additional American-cured pork cuts. The Netherlands also has been persuaded recently to accept fresh pork through the combined efforts of the Department of Agriculture and the Department of State.

To remove prejudice from the minds of European consumers, a moving-picture film entitled "The Honor of the Little Purple Stamp," showing methods of handling and inspecting meat, has been circulated among hygienic and meat-inspection societies of England, France, and Germany. Another film intended to remove prejudice against American pork has been produced by the department for exhibition in Austria, Czechoslovakia, and Germany.

#### BUREAU OF HOME ECONOMICS

Recognizing the necessity for more inclusive scientific study of the problems of home economics if this subject is to develop and



to make the contribution to our national life which it should make, the department established a new Bureau of Home Economics on July 1, 1923. In general the organization of the bureau has followed the lines laid down by a committee of technical workers called together in June, 1923 to outline its work. This committee recommended six lines of work for the bureau: (1) Food and nutrition; (2) clothing and textiles; (3) economics (including household management); (4) housing and equipment; (5) home relations; (6) art in the home (including the physical and psychological laws of color, line, and form).

In order that this program might be adapted as closely as possible to the needs of the women in the home, the presidents of several women's organizations were asked to send representatives to a conference held in Washington on December 14, 1923. This group agreed that the proposed plan covered the material or mechanical side of home life, but considered it important that the less tangible side should also be emphasized. Many agencies are telling women how to do their household tasks. It is equally important for them to know why certain practices are recommended. Clear-cut standards of value are needed. Such standards must be based on facts.

Expansion in the work of the bureau has been slow, due partly to limitation of funds. A large proportion of the home-economics work previously under way was in food and nutrition. This work has been continued. Farm standards of living have been investigated. This work has been expanded and forms an important part of the present work of a new division in the bureau. Research studies on textiles and clothing have been started. This work was made necessary to answer the questions of the housewife and adequately assist her in selecting and caring for the textiles and clothing used in her household. This division was organized near the close of the last fiscal year.

A study of oil burners for heating has been conducted and arrangements tentatively made for the preparation of bulletins on different phases of housing and home equipment.

#### BUREAU OF DAIRYING ESTABLISHED

As authorized by Congress the dairy work formerly conducted in the Bureau of Animal Industry was concentrated in the new Bureau of Dairying on July 1, 1924, and plans were made to expand dairy research work to keep pace with development of the industry.

In dairying one of the greatest needs is to improve the efficiency of our dairy cows. Although marvelous producers of milk and butterfat have been developed, many individual cows producing more than 30,000 pounds of milk and 1,000 pounds of butterfat a year, still

the average production of all cows in the United States is only about 4,200 pounds of milk and 160 pounds of butterfat.

To improve this condition the department is making a comprehensive study of dairy cattle breeding and has undertaken fundamental researches in nutrition of dairy animals. Over 1,500 dairy cattle are included in the breeding experiments. Of these, about 500 belong to the department, 500 are owned by State agricultural colleges and experiment stations cooperating in this project, for which the department supplies the sires, and about 500 are on 55 private dairy farms where department bulls are loaned for the purpose of proving their transmitting ability. The owners of these private herds agree to keep all daughters of the bulls until they have completed one lactation period and to keep a record of the production of both dams and daughters.

In these experiments the effects of various forms of mating are being compared, such as close breeding compared with the mating of unrelated animals. The purpose is to determine the method of breeding that will enable the dairyman to breed cattle that will be pure for the hereditary factors which govern high production. Such animals will be able to reproduce offspring of uniformly high producing ability.

Much may also be learned in regard to the most economical feeds used and just what system of feeding will produce the greatest amount of production at the least cost. Little is known of just how feeds consumed are converted into milk and of the relation of feeding methods to the health of herds. Extensive research is under way which should lead to the solution of these problems. Laboratory facilities have been enlarged by the erection of a special building for nutrition investigations at the department's dairy farm near Beltsville, Md.

#### DEVELOPMENT OF EXTENSION WORK

The most important recent developments in the cooperative extension work conducted by the department and the State colleges of agriculture are in the training and use of community leaders and the building up of State and regional agricultural programs. The work of the county agents in agriculture and home economics has been greatly supplemented by enlisting the services of voluntary helpers and training these workers for effective community leadership. During the past year 182,380 such leaders assisted in presenting the extension programs. Greater progress has been made in the training and use of local leaders in the home economics and boys' and girls' club projects than in the agricultural projects for adults, although in some of the States local leadership is being developed among the men. Local leaders have been very effective in assisting

paid extension workers in promoting such home-economics projects as home canning and preserving, gardening, and the home manufacture of clothing and millinery and in boys' and girls' club projects, such as poultry raising, feeding of calves and pigs, bread making, canning, and preserving.

In the earlier years of extension work much attention was given to community and county programs for agricultural and home economics extension. During the past two years these local programs for agriculture have been expanded to a state-wide basis in several States. The most successful development of State agricultural programs has been in those States where a thorough survey was made of all available facts on present and possible future production, marketing facilities, and other factors which influence the establishment and maintenance of successful agriculture. These facts, when assembled, are presented to a conference composed not only of agricultural leaders and representative farmers, but of representatives of bankers' associations, railroads, business interests, livestock associations, and all other agencies in any way related to agriculture. Committees of the conference then work out programs for particular phases of agriculture such as horticulture or dairying, and finally the several committee reports are united into a unified agricultural program for the State. This State program is then taken back to the counties and is adapted there to local needs. Western extension workers have gone further than this and have outlined an extension program in dairying, human nutrition, and range livestock production in the 11 Western States.

At the end of the year the total forces engaged in cooperative extension work in the States numbered 4,744 persons. Of these, 3,427 were located in the counties, 2,174 being engaged in county agricultural agent work, 851 in home demonstration work, 133 in boys' and girls' club activities, and 269 in extension work with negroes. In addition, 696 full-time and 174 part-time subject-matter specialists, with headquarters at the State agricultural colleges, supplemented the work of the county extension forces. Supervisors, assistant supervisors, and administrative officers numbered 447. The States, counties, and local agencies now contribute about \$1.70 to each dollar of Federal funds provided for extension work.

#### RADIO SERVICES DEVELOPED

Progress in the use of radio for the dissemination and reception of agricultural information during the past four years has kept pace with the general development of this new American industry. It is conservatively estimated that there are now about 375,000 radiophone receiving sets on farms in the United States, which is an increase of over 165 per cent in one year. In a short



time agricultural communities, however remote they may be from ordinary communication facilities, probably will be on equal terms with populous centers in obtaining market reports, weather reports, and other information essential to their welfare.

Following an experiment which was conducted in 1920, the department entered upon a program for the distribution of reports by the use of the radio-telegraph which, if there had been no radio-phone broadcasting, would have placed within the reach of the farmers over the country a radio-telegraphic service as extensive, perhaps, as that now enjoyed by those who have access to the telegraph facilities of the country.

The advent of radio-telephone broadcasting in 1921 placed in the hands of the department a means of giving to the farmers of the United States, directly by the voice, a variety of information essential to agriculture. The value of this means of distribution, and the fact that it works as rapidly as the passage of light or electricity, compelled us to confine our broadcasting material to reports and statements which required such a rapid style of transmission.

Market reports were first broadcast by radio-telephone from the University of Minnesota in February of 1921. The first regular schedule of reports was begun by station KDKA at East Pittsburgh, Pa., in June of that year. At the beginning of 1922, nine broadcasting stations were duly authorized to disseminate market reports from branch offices. During 1922 more than 100 stations requested the privilege of conducting the market news service by radio for the benefit of farmers. Regular schedules were organized and set in operation in more than 80 stations in different parts of the country.

During the two years that have followed new stations have been added, and some of those which originally took up the work have discontinued service. Although there are not now many more stations than there were at the close of 1922, the service which the 85 stations now in operation are rendering is much improved and is of real benefit to the people of the country.

Perhaps the most outstanding development in the broadcasting of market information in the last couple of years has been the appreciation on the part of those charged with the work of the need of suiting the type of material to the radio audience listening in. It has been found that much more general distribution and a wider reception of agricultural information can be developed by changing the style of broadcasting from that of detailed market quotations to a more generalized treatment of the information. Reports regarding the supply, demand, and prices of agricultural products can be made of interest to a larger number of people when the facts are presented in an interesting way. This, however, does not discount the value of

detailed quotations for those who have crops or livestock ready to ship or on the market.

The potential value of meteorological service to agriculture has long been recognized. For many years it was difficult to reach farmers with weather forecasts and warnings in time to be helpful to them. For this reason the benefits to commerce and navigation far exceeded those to agriculture. The rural mail service has been of great assistance, but during recent years the most direct and successful means of furnishing timely weather information to farmers has been through rural telephone systems. Weather forecasts and warnings issued about 9.30 a. m. daily are now made promptly available to over 7,000,000 rural telephone subscribers in the United States.

Radio, however, has reached a stage of development in which it bids fair to outstrip all other means of communicating weather information to farmers. Since January, 1921, when the first regular radiophone broadcasts were begun from the station operated by the University of Wisconsin at Madison, every opportunity to use the radio for broadcasting weather news has been utilized. The department now cooperates with 120 broadcasting stations in sending out weather reports and practically all parts of the United States are within their range. The daily weather forecasts are radio-cast from each of these stations on announced schedules at least once daily, and several times a day in many cases. Warnings of cold waves, frosts, floods, heavy snows, and other unusual weather conditions are included whenever they are issued. The stations now broadcasting have been selected with a view to rendering country-wide service.

In addition, the department is cooperating with a large number of stations in supplying digested agricultural news, special talks, and the preparation of material upon their direct request.

#### FEDERAL HIGHWAY CONSTRUCTION

The Federal highway act, signed by the President on November 9, 1921, is one of the high-water marks of highway legislation in the United States. It is the logical outcome of the tendency toward scientific management and orderly procedure in the development of the roads of the country which began with the creation of the first State highway department in New Jersey in 1891 and which was given renewed impetus by the Federal aid road act of 1916. The effect of the earlier Federal legislation was to establish in every State an adequate highway department competent to deal with the difficult problems attending the upbuilding of the main roads of the country to make them fit for the use of the rapidly increasing number of motor vehicles.

The important provision of the Federal highway act is the establishment of a connected system of main interstate and intercounty highways, the improvement of which is to be accomplished with Federal aid. The law limits the extent of the system to 7 per cent of the existing mileage of record in the various State highway departments at the time the law became effective, and provides that the roads to be included in it shall be designated by the several State highway departments subject to the approval of the Secretary of Agriculture.

Within two years of the signing of the act the important work of selecting the roads had been completed and a map of the approved system, including 168,881 miles, was published on November 1, 1923. Since that time there have been additions in several States which bring the total approved mileage up to 171,687 miles.

It is estimated that the construction of the roads of the system will require approximately 10 years. In that time every city or town of at least 5,000 population will be connected by a network of modern roadways built in accordance with scientific principles, and every link designed to carry with safety and economy the traffic to which it will be subjected.

All highways upon which Federal-aid funds have been expended since the approval of the act are parts of the system, and practically all Federal-aid roads previously improved are also included. At the close of the fiscal year the completed Federal-aid roads amounted to 35,157 miles, with 15,350 miles additional under construction reported as averaging 56 per cent complete. With the exception of a very limited mileage, improved before the passage of the Federal highway act, all of these roads are included in the system. In addition it is probable that more than an equal mileage has already been improved by the States and counties without Federal aid.

Already three States have completed the system originally designated and additions have been approved as provided by the law. In the country as a whole it is probable that the mileage improved is fully half the total mileage of the system.

No less important than the construction of roads under the Federal highway act are the fundamental scientific researches which have been conducted by the department during the past four years. It is impossible to overrate the importance of this work, the results of which constitute a large proportion of the considerable body of scientific knowledge that has been acquired in recent years. The researches of the Bureau of Public Roads cover the entire field of highway management, construction, maintenance, and finance.

#### PACKERS AND STOCKYARDS ADMINISTRATION

Through administration of the packers and stockyards act, passed on August 15, 1921, there has developed in the selling and handling



of livestock a noticeably greater feeling of security and freedom of action against imposition and unfair practices, which alone has done much to accomplish the purposes of the law.

At the close of the fiscal year ending June 30, 1924, 77 public stockyards in 66 cities and 32 States had been found subject to the provisions of the act and posted accordingly. More than 4,000 dealers and 1,100 market agencies have registered, and approximately 500 packing concerns are subject to the act.

Stockyard companies, market agencies and packers render periodical reports showing their income and expenses and financial condition. During this year, audits have been made and statistical and financial reports obtained from 58 stockyard companies and the work of valuing stockyard property in connection with determination of rates has been performed at several of the most important markets under the direction of competent valuation engineers and accountants. The accounts of 650 old-line commission firms and 25 cooperative organizations doing business at 51 markets have been audited. These markets handle approximately 98 per cent of the total livestock business at the markets subject to the packers and stockyards act. Financial statements were obtained for the year 1923 from packers subject to the act, the aggregate of whose slaughtering business represented approximately 98 per cent of all slaughtering done under Federal inspection during the year.

It should be noted that in all instances wherein the requirements of the act can be met informally, the policy of the administration has been to proceed in this manner. This has resulted in the satisfactory disposition of many hundreds of matters without the delay and expense resulting when formal action is required. In numerous instances, however, the nature of the cases and the requirements of the act necessitated formal action, and 112 formal proceedings have been instituted by the administration, 65 of which have been disposed of, leaving 47 still pending.

As examples of some of the matters that have been dealt with, brief mention will be made of a few of the most important. The use of short-weight butter cartons, which actually contained only 15 ounces but which were designed to hold 1 pound, was discontinued in certain sections of the country. Through cooperation with the Bureau of Animal Industry, beneficial adjustment has taken place in connection with prices of reactor cattle, resulting in increased returns aggregating many thousands of dollars to owners of this class of animals.

Through the efforts of the administration, all livestock consigned for sale on the public markets is now placed on the open market, which was not always the case at all markets previous to the passage of the packers and stockyards act. Such practices as weighing-up,

string sales, boycotting, and rebating, as well as similar objectionable practices, have been stopped in many instances.

Two of the members of the staff of this administration were agreed upon as arbitrators in connection with the determination of commission rates at four of the principal markets wherein complaints have been made by leading livestock organizations concerning these rates. This resulted in lower commission rates and direct annual savings to producers of approximately three-quarters of a million dollars.

All commission agencies are required to carry bonds to secure the faithful and prompt accounting for and remittance of the proceeds of sale of livestock consigned to them for sale. Shippers' proceeds accounts, which keep separate from funds used for other purposes all money received through the sale of consigned livestock, have been established by commission agencies at most markets, thereby doubly assuring payments to owners of livestock.

The way has been opened for farmers' cooperative selling agencies to operate in the terminal markets not by favoritism or partisanship but by enforcing the open-market principle. The number of cooperative commission companies has increased from 7 at the time the act was passed to 25, or an increase of 18.

Cases with reference to rates and charges of stockyard companies which involve the fundamental principles of proper rates, including such matters as the valuation of properties and the determination of properties that should be included in rate-valuation work, have been handled. There have been several cases of this kind, including one at Peoria, Ill., in which a material reduction in rates was upheld by the Federal court.

Scales in the stockyards are being standardized according to the actual needs of the business, and periodical testing under approved conditions is being brought about rapidly. The mistreatment and bruising or injury of animals at public markets have been materially reduced, thus resulting in a material economic saving. Payments for dead and crippled animals have been placed on a more systematic basis.

The formal dockets of the administration cover practices considered to be in violation of the act, including rebating, rendering false account sales to shippers, wrongfully withholding funds from shippers, discrimination through boycotting, usually practiced by so-called old-line commission firms against cooperative selling agencies and other nonmembers of exchanges, and the acquisition of the properties, business, and goodwill of Morris & Co. by Armour & Co., thus combining the second and third largest packers in the country into the largest concern. The investigation and hearings in this case have covered a period of more than one year and several hundred

witnesses have been examined. The final hearing will be held in the near future.

#### GRAIN FUTURES ADMINISTRATION

The grain futures markets of the United States have now been under the supervision of this department for somewhat more than one year, as provided by the grain futures act. This act went into full legal effect on April 16, 1923, when its constitutionality was finally affirmed by the Supreme Court of the United States.

The experience that has been had under the act is still brief, but it has sufficed nevertheless to indicate some of the landmarks by which the grain futures administration must be guided in carrying out the purposes of the act.

The oldest activity under the act has been carried on under section 8 which authorizes the Secretary of Agriculture to investigate grain marketing conditions, including the operations of boards of trade, and to publish the results, in statistical form or otherwise. This corresponds to one of two sections of the future trading act of 1921 which were not held unconstitutional. It was reenacted in the grain futures act of 1922, supported by provisions held constitutional in 1923 requiring members of boards of trade to keep certain records and to make certain reports. Experience is showing that this constitutes the central feature of the act.

The act itself is coming to be recognized as a milestone in the history of futures trading. This is growing because appreciation attaches to the declaration of Congress that trading in grain futures on boards of trade is affected with a national public interest and must be recognized and conducted accordingly. The primary responsibility for observance of the requirements of the act is imposed upon the boards of trade themselves in their organize capacity, subject to Government supervision. The boards of trade, in qualifying for designation as "contract markets," evidenced their acceptance of this responsibility by enacting rules in accordance with the act, providing, among other things, for the making of records and reports and forbidding their members to attempt to manipulate the market by the dissemination of misleading market information or in any other way. The result has been to put the whole business of trading in grain futures upon a new basis.

This new basis has been evidenced in judicial decision and in a more discriminating public opinion. Thus the supreme court of Kansas, building upon the case in which the Supreme Court of the United States upheld the constitutionality of the grain futures act, held on January 12, 1924, that a member of the Chicago and Kansas City Boards of Trade, both "contract markets," may not be prevented by State legislation from doing a grain futures



commission business according to the rules of those exchanges because Congress has undertaken the constitutional assumption of regulatory power. A discriminating public opinion is beginning to grow up on the basis of facts ascertained and published by the grain futures administration or known to be accessible to it now by reason of the act, the regulation adopted pursuant to the act, and the presence of Government supervisors at important "contract markets."

The intention of Congress as understood by this department has been to dispel the mystery which has always beset the public mind with reference to trading in grain futures. The dispassionate collection and analysis of exact and comprehensive information is accordingly being emphasized. Some of this information has been published, in forms suitable to serve the public interest but without violating those provisions of the act which forbid the separate disclosure of the transactions of individuals, trade secrets, or names of customers.

Thus the volume of trading in grain futures on each of the principal boards of trade has been currently published ever since December, 1923. For the Chicago Board of Trade, which handled during the years 1921 to 1923 over 87 per cent of the trading in grain futures, the total volume of trading for each day, beginning January 2, 1924, has been published on the following day. More recently the volume figures for Minneapolis and Duluth have been published daily. Information regarding aggregate commitments, as "long" or "short," and changes therein, hitherto unavailable, is also being published upon occasion, together with information concerning deliveries of grain on futures contracts. In short, the grain futures administration is laying before the public significant facts regarding the operation of the grain futures markets as rapidly as the administration can assemble such facts and determine their correctness.

The result of this policy is beginning to show itself in the tone of popular discussion. Guesswork and misrepresentation concerning the volume of trading in grain futures are beginning to give way to questions concerning the components of this volume, as pit trades, hedging trades, speculative trades, spreading operations, and the like, together with attempts to explain and interpret fluctuations in the volume which take place from time to time.

Among the facts which the public is accordingly able to observe for itself is that preliminary studies of the grain futures administration based on data for three and one-half years indicate that there is a close correlation between the volume of trading on the one hand and the range and frequency of price fluctuations on the other. Days, weeks, and months during which the volume of trading is

large are almost always those during which price fluctuations are wide and frequent; when the volume of trading is small price fluctuations are narrow and infrequent. For the year ended June 30, 1924, the first of these conditions held during about seven months and the second during about five months. During June, 1924, when prices were advancing rapidly, the markets were more active than they have been for a year, and during July, 1924, the total trading for all markets (2,172,574,000 bushels) was greater than it had been during the month of July in any of the preceding three years.

When the grain futures act went into effect in April, 1923, a generally downward movement had been under way for fully two years, both in the prices of wheat futures and in the volume of trading therein. The downward price movement halted in July, 1923, but the generally downward tendency of the volume continued through December. At the end of 1923, however, according to the best estimates, the wheat-futures markets were carrying more than twice as many "hedged" as at the end of 1922.

It is noteworthy that the general tendency of wheat prices has been upward during harvest time, a time especially interesting to farmers, for both the seasons during which the grain futures act has been in effect. The price of wheat in the United States during the year July 1, 1923, to June 30, 1924, furthermore, was generally above the level of wheat prices in competing countries, a fact reflected in smaller exports of American wheat. The strength of the wheat-futures market was very generally given credit at the time for sustaining American wheat prices, and subsequent developments, notably increased European consumption and a short crop in 1924, have shown that if American wheat prices had been even higher last year, resulting in a larger carry over of American wheat to sell at price levels now current, better returns might in the end have been obtained by sellers. These developments of course were not adequately foreseen, but the light which they and other facts throw upon the preceding years shows that close observation and study must be carried on currently in order to determine in what particular respects the grain-futures markets, judged from the standpoint of the national public interest as price-determining or price-registering institutions, fall short of perfection and what remedies should be applied.

#### PROGRESS IN FORESTRY

A substantial advance in forestry has been made during the past four years. While many problems remain to be solved, large gains have been made in the public conception and appreciation of the necessity for forest conservation, the legislative groundwork for National and State forest policies, and the actual extension in the woods of forest protection and better forest practice.

The outstanding facts of our present situation as to timber supply and the idleness of lands suitable for forests have become common knowledge. Both the menace of far-reaching national losses and the lines of action that should be taken have been markedly clarified through comprehensive study and publications. The country has assimilated the facts and caught their significance. This in itself represents one of the large gains of recent years. The essential place of forestry in the land program of the United States is now widely recognized. Over 95 per cent of our total land area consists of farms, forests, or potential forests, improved pasturage, and open ranges. Crop production, animal husbandry, and forestry are the three great uses which must be made of this vast soil resource to promote both individual and national prosperity. These three forms of land use are closely interrelated and all are intimately related to the conservation and beneficial use of our water resources. About one-fourth of our total land area is forest or potential forest. In addition to the vast areas of mountain and other nonagricultural lands which can be made of permanent utility only through the practice of forestry, timber culture is being more and more clearly recognized as an important factor in diversified agriculture.

The 470,000,000 acres of forest land in the United States can supply in perpetuity the timber products required to meet our economic needs. Right handling of our forests will also safeguard the water resources and provide for public recreation and other needs as concurrent uses of the land. Our forestry problem has resulted from the idleness or half use of enormous areas of forest-producing soil in the United States, and the fundamental solution is to bring about the full employment of all the land in the United States which is better adapted to timber crops than to other forms of use. We are now so far from making full use of the growing power of our forest lands that they replace each year not more than one-fourth of the current drain upon their timber; and at the same time idle forest lands are imposing oppressive burdens upon other property and upon rural welfare.

To bring our consumption of wood and our production of wood into balance will necessarily be a long and difficult task. It can not be fully accomplished for several decades, and a shortage of timber must be faced in the meantime. That it has already begun is evidenced by the rise in lumber prices, by the heavy tolls imposed upon consumers for transporting lumber from great distances, by the decline in per capita use of lumber of nearly half within the last 20 years, and by the fact that for such an important forest product as paper the United States now depends upon foreign sources for more than half of its current consumption. With these salient facts the American public has now become generally conversant. The dis-



criminating support of National, State, and local movements and developments toward forest conservation was never so widespread or effective as at present. A specific result of this growing national interest and concern was the enactment of the Clarke-McNary law on June 7, following several years of nation-wide discussion and investigation.

#### PUBLIC OWNERSHIP AND MANAGEMENT OF TIMBER LANDS

The policy of permanent Federal ownership of forest properties was begun about 33 years ago, with hesitation. At first there was much doubt of the wisdom of substituting for the traditional policy of disposing of the public lands a program that put the Government into the business of land management and the growing and marketing of timber on a huge scale. The general application of the new principle to the public lands suitable for timber production was sought by President Roosevelt but denied by Congress because of its conflict with the settled tradition of distributing public lands for private use and because of many questions raised as to the success of a public enterprise of this nature. The national forests had to justify themselves by their results.

The Clarke-McNary law has given added scope to this feature of our national-forest policy. Provision is made by its terms for extending the national forests over lands already in public ownership adapted to this form of administration, (1) through the classification of such portions of the remaining public domain as are adapted primarily to the production of timber or the protection of watersheds, and (2) through the creation of national forests covering such parts of military and other reservations as are also primarily adapted to this form of use. The same law authorizes an important expansion in the policy of purchasing forest lands under the Weeks law through the extension of such purchases, within the watersheds of navigable streams, to include areas needed primarily for the growing of timber as well as areas needed for protecting the watersheds of rivers. Other means are provided for the extension of national forests through the acceptance of gifts or bequests of lands adapted to this public use, subject to reasonable and suitable reservations. By this act the policy of national ownership and administration of forest lands has not only received specific confirmation but has been afforded the basis for a material expansion in the future. The national-forest system now embraces about one-quarter of the timber-producing lands in the United States.

Forest ownership by other public agencies has always been sought by advocates of conservation, as there is every reason why States and municipalities should share this important function with the

National Government. Significant and promising developments in this field have taken place within the past four years on the part of several States and also through the creation of a considerable number of town or county forests, particularly in New England. Both of these developments are indications of the extent to which the idea of better use of our forest land is extending among the American people. The State forests now exceed five and one-half million acres, with every prospect of being rapidly enlarged under the State programs now in effect or proposed.

#### ANIMAL-DISEASE WORK PUSHED

The scientific study of animal diseases and parasites has yielded information of practical value in combating these enemies of the livestock industry. A new and very effective immunizing agent against hemorrhagic septicemia has been developed. This infectious disease, which attacks especially cattle, sheep, and swine, is attended with a very high mortality. The protecting product is what is known as an agressin. In the experiments cattle which had been immunized with this agressin were given five hundred times the fatal dose of hemorrhagic septicemia virus with no ill effects, while all untreated cattle given the same dose of virus died within 48 hours. Field experiments in the control of hemorrhagic septicemia are being carried out at several stockyard centers.

Incomplete experiments in applying the antihog-cholera serum treatment to very young pigs indicate that this can be done safely at an early age and that under normal conditions the pigs will be protected against hog cholera until the usual market age.

In recent years an effective method of controlling stomach worms in sheep by means of repeated dosing at intervals has been worked out. Carbon tetrachloride, which was found by the department to be effective against hookworms of dogs, has since come into very extensive use in human medicine for the removal of hookworms and has been used with great success in hundreds of thousands of cases in various parts of the world.

#### WAR ON PLANT DISEASES GOES FORWARD

During the past four years further stimulation has been given the campaigns being waged against the host of plant diseases which menace certain important crops and present a serious economic problem in American agriculture. A brief résumé of the work being done with a few major diseases will illustrate this phase of the department's activities.

Continued progress has been made in the control of the white pine blister rust. This destructive disease is established in the United States and its rapid spread threatens the destruction of five-needled

pine forests containing over 78,000,000,000 board feet of timber, valued at approximately \$500,000,000. The harvesting and utilization of this timber sustains many industries and gives employment to thousands of wage earners. Therefore, continued production of this forest crop is of vital regional and national concern because of its present economic value and its relation to sustained forest productivity.

Local control measures consisting of systematic eradication of the alternate host plants (currants and gooseberries) within 900 feet of pine stands were developed early, and thorough test proved them adequate for use in northeastern United States. In cooperation with the States, the department in 1922 undertook an intensive campaign to control the rust by obtaining prompt application of control measures by pine owners. Agents stationed in the important pine-growing counties or districts of the infested States give landowners the expert advice, local leadership, and supervision needed to secure prompt and effective protection of the white pines. Currants and gooseberries have been destroyed on control areas aggregating approximately two and a half million acres. Local public interest is evidenced by the active participation of 3,325 individuals and 346 communities, who have expended \$194,000 of private funds in control work. Control measures have been applied on the White Mountain National Forest, where much of the white pine has already been protected from the blister rust by the eradication of currants and gooseberries.

An outbreak of blister rust was discovered in western Washington in 1921. The disease, which had become established in British Columbia some 10 years previously, had spread rapidly, and in 1923 its eastward extension was within 35 miles of the inland empire pine region of Washington and Idaho. Cooperating with the States concerned, the department is vigorously prosecuting a 10-year program to check the further spread of the rust and develop practical measures for its control in localities where valuable timber is threatened. During the past three years the primary alternate host plant of this disease, the European black currant, has been largely eliminated in western and northeastern Washington, northern Idaho, western Montana, and western Oregon. Effective quarantines have been maintained and good progress has been made in devising cheap and practical means for the local protection of pines in infested areas.

The campaign for the eradication of the common barberry to prevent the spread of black stem rust of wheat was begun in a preliminary way in the spring of 1918 and has completed its sixth full year.



The yearly appearance of severe local epidemics of stem rust, which were traced to barberry bushes remaining in certain counties previously surveyed and thought to be clean, made a second complete survey advisable in several counties during the past year.

The spread of escaped barberries to open woodlands, fence rows, rocky ledges, brushy pastures, and stream banks is the most serious problem of the campaign. Not all bushes among undergrowth and weeds are found on the original survey and some may be overlooked on the first resurvey. Seedlings continue to appear each spring for a number of years after all fruiting bushes are destroyed. A total of 3,600,669 escaped bushes has been found on 4,717 properties to date. In addition, most of the 3,825,478 seedlings found on original survey and resurveys were in areas of escaped bushes.

The eradication of all bushes and seedlings from areas of escaped bushes is progressing as rapidly as possible. Many small areas appear to be cleaned. The complete clean-up of many larger areas is in sight because of the general use of crushed rock salt as a killing agent during the past season.

Experiments on chemical methods of eradication begun in September, 1921, have given excellent results. Two chemicals have given uniformly good results. These are crushed rock salt and a sodium-arsenite solution. The sodium-arsenite solution proved dangerous to livestock and poultry and its use has been discontinued. Crushed rock salt and flake or packers' salt have proved effective and may be applied at any time of year. One or the other usually is available or can be procured in a reasonable length of time. Experiments are still in progress with five other chemicals. Of these kerosene has proven effective but very slow in action. A total of 3,074,587 bushes, seedlings, and sprouting bushes was treated. During the fiscal year 1924, an area equivalent to approximately 183 counties was covered in the original survey, 271 counties in the resurvey, and about 53 counties in the second survey. A grand total for the year of 4,041,575 bushes, seedlings, and sprouting bushes was found and 4,012,258 were eradicated.

The cooperative campaign for the eradication of citrus canker, conducted in cooperation with the Gulf States, is making satisfactory progress. In the eight years that the department and the Gulf States have been cooperating in the eradication of citrus canker Florida, Alabama, and Mississippi have been practically freed from this destructive disease, and the infections in Texas and Louisiana are now much less serious than in earlier years.

The methods of eradication are more extreme than have been found necessary in fighting any other plant disease on account of the extreme infectiousness of citrus canker. All infected trees found by the inspectors are burned, and additional safeguards such

as requiring the inspectors to wear outer suits, shoes, and hats that are thoroughly disinfected both upon entering and leaving citrus properties are employed. The success of this campaign may be said to have established a new era in preventive and control work in dealing with plant diseases.

#### DAMAGING INSECTS HELD IN CHECK

Equally important as plant diseases in their economic relation to agriculture in this country are insect pests. The warfare against these pests grows more tense and more scientific year by year. To prevent the entry of new plant pests of all kinds, some 22 quarantines, either prohibiting or restricting and safeguarding the entry of products known to be likely to carry such pests, are now being enforced. This enforcement involves the maintenance of a port inspection service at all important ocean and border ports of entry into this country. The important products thus brought under restrictions as to entry include cotton, various cereals, nursery and ornamental stock, and all fruits and vegetables. This service has been largely developed during the past four years and it is significant to note that since the plant quarantine law was passed not a single new major pest has entered this country.

The work of enforcing the Federal quarantine on account of the European corn borer, in cooperation with the several States, has been excellent and has prevented the spreading of the pest through commerce in affected products. More than a million individuals of a useful parasite have been brought from Europe and liberated in the infested regions. Other promising introduced parasites have been established in New England and have been liberated on the eastern edge of the corn belt in Ohio, where the corn borer has become established comparatively recently.

By inspection of products likely to carry the gipsy moth, its spread has been checked and no new colonies have become established at long distances from the generally infested New England area. In New Jersey no injury to foliage has resulted since the first year, and the area has now been reduced more than one-half. The area in New England infested by the brown-tail moth has decreased nearly 3,000 square miles during the past four years.

Experiments have resulted in the development of more efficient methods of control, and the introduction of many thousands of parasites and other natural enemies from Europe and Japan has aided in gradually reducing the increase of both gipsy moth and brown-tail moth in the sections of New England that have been longest infested. The area defoliated this year is much less than in previous years.

The department has been attempting to determine the principles in the cotton plant that cause the boll weevil to feed on this plant alone, but it is only recently that any great measure of success was gained. Large quantities of cotton plants were collected and either distilled or otherwise processed to obtain a complete understanding of the chemistry of the cotton plant. Some of the most promising of the substances isolated have been tested in the field during the past summer, and certain of them possess attractive qualities apparently slightly superior to those of the cotton plant itself. Experiments are still going on, and definite conclusions may not be reached for another year, but the outlook is hopeful. Once in possession of such an attractant, a promising new line of remedial work at once becomes available.

The pink bollworm of cotton is generally recognized as one of the worst of all cotton pests. It originated in India and is now generally established in practically all the important cotton-producing countries of the world except in the United States. About 1915 it gained entrance from Mexico into Texas and later spread to portions of Louisiana. It also obtained some foothold in western Texas and New Mexico directly from Mexico.

A hard fight to eradicate it has been in progress since its first discovery in Texas in 1917. No new areas of infestation have been located during the last two years, and except in the western districts of Texas and in New Mexico no reinfestation has developed in any of the territory where the insect previously had been established. This means that the more important areas originally infested, in central and eastern Texas and in Louisiana, are apparently free from this pest and this freedom has now continued for three years.

In western Texas and in New Mexico no continued effort has been made to eradicate the pink bollworm, for the reason that the proximity to the Mexican border makes reinfestation almost certain. The danger of infestation spreading from the western areas eastward is, however, being controlled by quarantine, by the installation of seed-disinfection machines in all gins, and by the separation of these areas from central and eastern Texas. It is not believed that the risk of spread from these areas of infestation is greater than that from the infested areas in Mexico.

To prevent the further entry of this pest from Mexico, all commercial and other border traffic into the United States is safeguarded by inspection and disinfection. This has involved the inspection, during the past year, of upward of 29,000 freight cars and the fumigation of nearly 17,000 of these. In addition, all vehicular and other movement out of Mexico is inspected and safeguarded. A fee covering actual cost of labor and chemicals is charged for the



disinfection of such cars and vehicles, and the receipts are turned into the Treasury, amounting during the year to \$67,730.50.

Although the Japanese beetle has continued gradually to enlarge its territory by annual dispersal, the quarantine and other operations carried out in cooperation with the States of New Jersey and Pennsylvania have been instrumental in preventing the spread of the insect to other parts of the country. Search for the parasites of the Japanese beetle was begun in 1920 in Japan, China, and Korea, and numerous large shipments of natural enemies have been introduced, some of which have become established.

#### MORE PROFITABLE USE OF CROPS

The application of science to the improvement of manufacturing processes in those industries that use agricultural products as raw materials, and the development of new manufacturing uses for products and by-products of the farm, provide a more profitable outlet for farm crops. The chemists of the department have developed and patented processes for the manufacture from corn cobs of an adhesive and of furfural, which is a chemical that can be used extensively in the manufacture of many useful appliances. These processes may soon be in use on a commercial scale that will provide a market for many corn cobs that are now practically a waste by-product.

A process has been developed by the specialists of the department for the manufacture of a palatable beverage resembling tea from cassina, a plant that grows wild abundantly along the Atlantic and Gulf coasts from North Carolina to Texas. A flavoring extract for use in making carbonated beverages has also been made in the laboratory from cassina and may soon be manufactured commercially. The cured cassina leaves suitable for making beverages are now manufactured commercially and are on the market.

A laboratory established at Los Angeles, Calif., has developed processes for making citric acid, citrate of lime, lemon and orange oils, marmalades, pectin, and other commercial products from cull and surplus lemons and oranges. These processes are now being used profitably by commercial concerns that purchase large quantities of cull oranges and lemons which were formerly wasted.

An improved process for the manufacture of a cane sirup that will not readily crystallize or ferment has been developed by the chemists and is now in successful operation in a large number of sirup manufacturing plants. The market for cane sirup has heretofore been restricted by the tendency of the sirup either to crystallize or ferment before it reached consumers. By developing a method that removes this difficulty, the specialists of the department have made it possible for the market for cane sirup to be greatly ex-

tended. Improvements have likewise been made in methods for the manufacture of sorgo and maple sirups. The department specialists are now engaged in studies looking to certain improvements in the manufacture of beet and of cane sugar, which it is hoped will aid in the extension of the domestic sugar industry.

Improved processes for the dehydration of fruits and vegetables have been developed and are in successful commercial use. Dehydrated fruits and vegetables much superior in appearance and flavor to the products dried by the old methods are now on the market. The extension of this most economical method for preserving and transporting fruits and vegetables is assured.

How to utilize profitably on the farm certain vegetables in the manufacture of pickles and of sauerkraut and certain fruits in the manufacture of vinegar has been worked out in the laboratory and the methods published.

A process for making a crystalline maltose sugar from cornstarch has been developed. The cost of producing maltose sugar from cornstarch is lower than the cost of producing cane sugar. The new process has yet to be industrialized, so that it is too early to realize its bearing on the utilization of corn. The investigational work is not entirely complete but has proceeded far enough to demonstrate that it is entirely practicable to make an excellent grade of crystalline maltose sugar from cornstarch or hominy.

#### THE HUNT FOR NEW PLANTS

Continued success during the past few years in introducing plants from all corners of the earth goes to confirm the belief that numerous possibilities still exist in this field of research. Many alien plants have been introduced and developed to a point where they have found a profitable place in our agriculture. Curiously enough the faith prevails in every district, however poor the soil may be, that it needs only the finding of the proper plants to make the land greatly more productive. The success with new forage plants goes far to give validity to this belief. One has only to consider such plants as alfalfa, the sorghums, Sudan grass, sweet clover, lespedeza, and velvet beans, all of comparatively recent introduction and utilization, to realize what a profound effect they have had in this country.

The agricultural explorations carried on by the department during the past four years have been especially important. They have included extended travel in Africa, Asia, and South America and have resulted in the importation of many valuable new plants. Explorations in southern China, Burma, and Siam resulted in the collection of trees from which chaulmoogra oil, a successful specific for leprosy, is obtained, and the establishment of these trees in the American tropics. Seeds of the gorli shrub, from Sierra Leone,

Africa, also contain chaulmoogric acid, and as this shrub is of quicker growth than the Asiatic tree from which the oil is obtained, it has been introduced as another source of this material.

Numerous varieties of Chinese chestnuts have been imported for testing for blight resistance in the hope that they will replace the rapidly disappearing American species. Many native Chinese apples, pears, cherries, plums, and roses were also obtained which, because of their vigor and hardiness, will be of special interest to plant breeders.

One of the department's explorers has recently returned from a trip to northern Africa, Abyssinia, and the Kashmir section of British India, where he went especially to obtain varieties of barley and wheat likely to prove of value at high altitudes, or for growing under dry-farming conditions in the Western States. Another explorer traversed Africa from south to north, obtaining many native plants of interest and value, some of which are likely to prove adapted to our Southern States. This explorer is an expert plant geographer and through his visits to Africa we have been able to obtain much valuable information about the agricultural possibilities of that continent.

During the past year the department sent its chief corn specialist to South America to obtain samples of corn from the Indian tribes in the high Andean country of Bolivia, Peru, Chile, and Argentina. Cornell University cooperated in this exploration by sending a member of its faculty who is one of the best known plant breeders in the United States. Many samples of corn were obtained which should prove of value to corn breeders, especially those who are developing early strains for the Northern States, and drouth-resistant varieties for the Southwest.

Near La Paz, Bolivia, and in the vicinity of Cuzco, Calca, and Huancayo, Peru, varieties were obtained that have been grown there since long before the discovery of America by the white man. These varieties possess many characteristics which make them of interest and possible value as breeding stocks in the United States. Those districts are located near the Equator, or from  $12^{\circ}$  to  $17^{\circ}$  south latitude, and so have a long frost-free period except at the highest altitudes. For the same reason the length of the days and nights is more nearly equal than in our Corn Belt. Because of the altitude, however, the temperature is relatively low, particularly during the night. These conditions have resulted in varieties of corn differing markedly from those grown in the United States.

The most important feature of barley investigations has been an extensive exploration for breeding stocks in Africa and Asia. In addition to barleys a large number of samples of other grains, legumes, and the various cultivated and wild plants were obtained.



The barleys of the western United States undoubtedly were introduced into America from Mexico, where they had been grown by the Spaniards. These barleys are all of the types commonly grown throughout North Africa, especially in the region from Tunis west to the Atlantic. It is certain that many types common in North Africa were not introduced by the early settlers and have not yet found their way to this country. The selections made in Algeria and Tunisia and later in northern Spain were barleys similar to the Coast variety of America.

In all there were 19 accessions of barley from Algeria and Tunis, 19 from Spain, 32 from Egypt, 30 from India, and 33 from Abyssinia. This does not in any way indicate the total number of barleys procured. Wherever the fields were in head all of the types from a single set of adjoining fields were selected, but placed under a single field accession number. The barleys from Algeria, Tunis, Egypt, and India were sown in November, 1923, at Sacaton, Ariz. In addition to the bulk samples there were over 700 rows grown from heads selected in fields of North Africa and India. Many of these gave very high yields. The selections from Egypt were particularly promising. There were some hundreds of selections of the two forms of Mariout, and it is hoped that some of these may be superior to the original introductions. The barleys from Kashmir gave surprisingly high yields. It is thought that the Kashmir type has not been previously tested at experiment stations in America.

Several new grasses from the Tropics give promise for southern conditions. These include molasses grass, which succeeds wonderfully on any of the well-drained soils, however sandy, of southern Florida; Bahia grass, the best grass yet found for permanent pastures in Florida and along the Gulf coast on the relatively dry lands; Guatemala grass, a tall coarse grass with thick juicy stems, very valuable for soiling; and Tracy grass, accidentally introduced on the Gulf coast and making a very dense sward on both dry and wet soils. Tracy grass is extremely difficult to eradicate when once established, but where pasturage alone is considered it is a grass of great merit.

#### RUBBER INVESTIGATIONS PUSHED

Investigations begun last year to determine the possibilities of rubber production in the United States and in adjacent tropical regions are being pushed forward to the extent of the available funds. The need of additional sources of raw rubber is becoming even more apparent with the further rapid increase in the volume of the rubber industry in the United States, and with our great preponderance in the use of motor vehicles. It is reported that the rubber industry has increased 35 per cent in the last two years, and that 11

motor vehicles are owned in the United States to 2 in all other countries. Apart from the danger of being so completely dependent on the East Indies for an indispensable material, it is plain that a scarcity may result in a few years from a continued growth of the industrial demand, either in the United States or abroad.

Though only one rubber-producing species has been cultivated extensively as yet, there are many other plants of widely different habits that require investigation before we can be assured of the best possibilities of producing rubber in America. Dry-country rubber plants are being investigated in southern California, Arizona, and Nevada, while rubber-producing trees and vines of tropical countries are being studied in their native countries to determine their suitability for conditions to be found in southern Florida, Porto Rico, and the Canal Zone, or in the neighboring countries. Special opportunities for such investigations have been found in Haiti, where plantings of several of the more prominent rubber trees, including the Hevea or Para rubber tree of Brazil, were made about 20 years ago. Labor would be available in Haiti if it appeared that commercial rubber planting would be profitable. Cooperation is being extended by the President of Haiti and a convenient location for experimental work near Port au Prince has been placed at our disposal.

From what has been learned in the West Indies, Central America, and Mexico there can be no doubt of the possibility of producing substantial quantities of rubber in tropical America if suitable cultural systems can be developed, not requiring oriental contract labor as in the East Indian rubber plantations. To use resident labor it is necessary to consider the production of rubber in connection with other crops, rather than the opening of special rubber districts where labor must be imported. The possibilities of utilizing waste lands for rubber production or for plantings that could supply emergency needs must be considered as alternatives to replacing other crops with rubber.

#### FIBER PLANT INVESTIGATIONS

There has been an increasing need in this country for hard fibers for use in cordage as well as in binder twines. Disturbed conditions in Yucatan have resulted in a falling off of supplies of henequén that has been the principal fiber used for binder twine, while the world demands for cordage fibers have increased materially over the requirements previous to 1914. There are probably 40,000 or more acres of land suitable for henequén or sisal in Porto Rico and the Virgin Islands under our own flag, but not enough to make up for the reduced production in Yucatan. Greater emphasis has been placed, therefore, on the work in the Philippine Islands, where

abaca, the only fiber suitable for high-grade ropes, is produced and where there are large areas with conditions of climate, soil, and labor favorable for the production of hard fibers.

Work in the Philippine Islands has been carried on along the following lines:

1. Fiber cleaning machines have been introduced, their work demonstrated, and their use encouraged. As a result the production of machine-cleaned maguey and sisal has become an established industry, yielding better profits and also better fiber than the hand-cleaning methods.

2. Sisal plants have been introduced and their cultivation encouraged, because they yield fiber of better quality than manila maguey. The production of sisal during the first six months of 1924 was 4,288 bales, which was more than twice the production during the same period in 1923.

3. The uses and methods of handling fibers in the cordage and twine mills have been studied and recommendations have been made to the producers, resulting in better methods of preparing and baling the fibers.

4. The inspection and grading of fibers by the Philippine Government, favored by all manufacturers, have been encouraged, improved, and more firmly established.

5. A study has been made of the "perished" abaca fiber that has been the cause of numerous complaints, especially in the London market, and the troubles from this source have been materially reduced. This form of deterioration is the result of storing the fiber in air-tight warehouses, causing a fermentation due to fungi or bacteria or to both.

6. Attention has been given to the threatened injury to the abaca industry by two diseases that have destroyed abaca plantations in the Provinces of Laguna and Cavite on the Island of Luzon. Recommendations have been made and are being acted upon by the Philippine Government for holding the diseases in check and efforts are being continued for more efficient measures to combat these diseases.

The production of manila maguey and sisal in the Philippine Islands now amounts to approximately one-third of the production of henequen in Yucatan. During the year ended June 30, 1924, more than 200,000 bales of abaca from the Philippines were used to eke out the decreasing supplies of henequen for the manufacture of binder twine in the United States.

#### NEW STUDIES OF PLANT LIFE

During the past four years it has been shown that in many plant species the relative length of day and night may be the controlling factor in flowering and fruiting and other features of development.



Some plants are promptly forced into flowering and fruiting by exposure to relatively short days, and exposure of these plants to long days will cause profuse and indefinite vegetative development without flowering. Other plants, however, tend to remain in the vegetative stage when exposed to short days and are quickly forced into flowering by the action of long days. Formation of tubers and bulbs, falling of the leaves, the condition of dormancy, development of branches, and extent of root growth also are subject to regulation by the prevailing length of day. Moreover, plants vary widely in their sensibility to this factor.

Through field and greenhouse studies it has been possible to establish the relationship of the length of day to early and late maturing varieties of crop plants, the comparative development of the vegetative and fruiting portions of the plant, the distribution of the growing and fruiting periods through the year, the everblooming or everbearing condition, the adaptability of different varieties and species of crop plants to different latitudes, and the natural distribution of plants.

In many species flowering and fruiting can be induced or suppressed at will by artificial control of the daily period of illumination. For this purpose the daily exposure to light during the long days of summer may be shortened by use of dark houses, and in winter artificial light may be used to lengthen the daily illumination period. It has been found, moreover, that plants can be readily grown to maturity with artificial light as the only source of illumination. Flowering and fruiting and other characteristic responses to differences in duration of the daily illumination period are brought about as easily with artificial light as with sunlight.

#### WHEAT BREEDING TESTS

The varieties of wheat grown in the United States number more than 200, known by more than 800 different names. A concerted effort has been made toward the standardization of varieties by communities and a reduction in the number and acreage of the poorer varieties. Improved varieties are being developed. A recent production is Nodak, a high-yielding, rust-resistant durum variety of excellent quality, developed as a selection from Kubanka in co-operation with the North Dakota Agricultural Experiment Station, which is distributing the new variety.

Kubanka was introduced by the department from Russia and is now the best adapted variety for all of the varying conditions in the durum wheat sections. It is a high-yielding wheat fairly resistant to rust, of good milling quality, and well liked for the manufacture of macaroni and other products. Nodak has outyielded

Kubanka at the Dickinson substation, where it was selected, by 1.3 bushels per acre during the seven years from 1918 to 1924, inclusive.

Karmont is a new, high-yielding, hardy variety of hard red winter wheat, selected from Kharkof, which is being distributed by the Montana Agricultural Experiment Station, with which it was developed cooperatively. Kharkof, which also was introduced by the department from Russia, is the highest yielding and most widely grown variety of hard red winter wheat in Montana and Wyoming. At the Moccasin, Mont., substation, where Karmont was selected, it has outyielded Kharkof by 1.6 bushels per acre during the six years from 1918 to 1923, inclusive.

The early efforts at wheat improvement by the department consisted largely of trials of introduced varieties. These were followed by improvement through selections of pure-line strains. As more difficult and specialized problems arose, the breeding of wheats by hybridization has been undertaken. This now offers the most scientific and reliable method for further improvement. Varietal trials with standard and new varieties are being continued at Federal and State agricultural experiment stations to determine their agronomic value.

Kota is a bearded variety of hard red spring wheat which is resistant to black stem rust. It was introduced from Russia and developed concurrently by the department and the North Dakota Agricultural Experiment Station. The rust resistance of the variety was first determined in 1918. In 84 trials, during the five years from 1919 to 1923, Kota averaged 9.6 per cent of rust infection, while Marquis in the same trials rusted 47.9 per cent and Kubanka durum 23.9 per cent. The acre yields of Kota have averaged considerably higher in North Dakota and South Dakota than those of Marquis, the standard variety of hard red spring wheat.

About 1,000 varieties and strains of wheat have been tested for bunt resistance cooperatively in California, Oregon, Washington, and Kansas. Of these a few have proved highly resistant. Hybrids of these resistant strains are proving very promising. Ridit, one of the most desirable of these, developed at the Washington Agricultural Experiment Station, has now been distributed to farmers. Two immune strains have been derived from the Hussar and Martin varieties, respectively. While these are not desirable strains for commercial growing, they have been crossed with good commercial varieties susceptible to bunt, and from these hybrids it is expected to develop commercially desirable bunt-free strains. Resistance also is being developed through pure-line selections of resistant plants from susceptible commercially desirable varieties. Several highly resistant strains of excellent quality have been obtained by this method.

### NEW CORN VARIETIES TESTED

In all commercial open-fertilized varieties of corn various deleterious characters are present which tend to reduce production. Among these injurious characters are barrenness, weak stalks, weak roots, twisted and crinkled leaves, deficient chlorophyl, poor silks or tassels, and susceptibility to different diseases, which reduce the stands and yields of open-fertilized corn. In corn-breeding investigations, self-pollinated strains free from these harmful factors have been isolated by continued selection. As a rule, however, strains inbred for several successive years are materially reduced in size and productivity. The recombination of these pure strains, after eliminating undesirable characters, is necessary in order to restore vigor and consequent high production. The hybrids from some of the recombinations of these strains, when grown in the field in comparison with the best commercial varieties, have already produced substantial increases in yield.

Numerous "selfed" strains of important commercial varieties of corn have been subjected to artificial smut infections during the past four years. A few strains have proved very resistant to infection. These strains, when grown in different localities, have shown the same comparative degrees of resistance. Hybrids from crosses of two resistant strains have shown consistently high resistance, while hybrids from crosses between a resistant and a susceptible strain and hybrids from crosses between two susceptible strains all are susceptible, showing that susceptibility is dominant.

### SUGARCANE INVESTIGATIONS

The gradually diminishing yields of sugarcane in recent years due to the failure of native varieties to resist mosaic disease, root rots, storage rots, and other diseases, are being successfully met by the introduction, selection, and breeding of new varieties.

About five years ago, when it became evident that the injurious mosaic disease was spreading at an alarming rate and would soon seriously affect our sugar industry as it had already affected that of several other countries, varieties known to be resistant to this disease were introduced. Ten varieties of cane were obtained from Argentina during 1919, but only two were found to be of any value. These were Kavangire (Uba), which is immune, and 234 P. O. J., which is tolerant to mosaic. At about the same time it was found that Cayana-10, a variety of cane previously imported from Brazil for sirup-production studies, was also immune from mosaic disease.

Steps were immediately taken to increase these three varieties and to test them throughout the sirup and sugar-producing sections. For sirup purposes, Cayana-10 has practically supplanted the old



varieties in the heavily infected areas. P. O. J. 234 and several subsequent introductions promise to do the same thing in the sugar-producing sections. Although these varieties are of great importance for increasing the present yields of sugarcane, they are only distributed as a means of tiding over the industry until they can be replaced by still better varieties now under observation.

#### FOREIGN CLOVER SEED STUDIED

A study, commencing in 1915, but interrupted by the war, of the reasons for red-clover failures showed that one of the causes of failure was the use of nonadapted seed. A large part of the red-clover seed used was found to be imported, chiefly from Italy and France.

The studies of the department in cooperation with the various experiment stations show that red-clover seed grown in Italy produces a plant not winter hardy enough to withstand our climate in the severe sections of the clover belt, as Iowa and Minnesota, and that this strain of red clover is also much more susceptible to the anthracnose disease so prevalent in the southern and southeastern portions of the clover belt. The weakness of this type of clover is so pronounced that the use of Italian clover seed is to be discouraged throughout the clover belt east of the Rocky Mountains.

Red-clover seed grown in other European countries and in Chile has not yet been so thoroughly tested, but it is already evident that red-clover seed produced anywhere in Europe west of Poland and south of the Baltic is not reliably hardy in those parts of our clover belt having very severe winters or where the snow cover is often scant. During less severe winters clover from seed produced in Bohemia and in northern France has come through the winter without serious injury. In the Ohio Valley and the States immediately surrounding the Great Lakes, except perhaps in New York, European clover seed, with the exception of Italian, has, so far as tested, given reasonable satisfaction. In the southeastern and southern portions of the clover belt, all European seed so far tested has produced a rather indifferent second crop, this weakness appearing to be due to a greater susceptibility to anthracnose.

#### PREDATORY ANIMAL CONTROL

Considerable progress has been made during the past four years in the control of predatory animals. During this period 2,542 wolves, 695 mountain lions, 11,625 bobcats and lynxes, 497 bears, and about 380,000 coyotes have been destroyed in these campaigns. This represents a direct gross saving to stock growers of not less than \$23,000,000, at a cost of \$1,101,820 to the department, and \$1,040,276 to cooperators. A few years ago when the department began its

systematic campaign against predatory animals in the public-land States the estimated annual losses from these pests were placed at more than \$20,000,000.

To this direct saving of livestock should be added the benefits from the suppression of rabies and the prompt control of outbreaks of this disease among coyotes and other predatory wild animals. This work has been conducted with such effectiveness that from its general spread in six of the western States rabies has been reduced to small sporadic outbreaks which are immediately suppressed by the concentration of trained men wherever the disease is reported. Without this prompt work in suppressing outbreaks it might spread rapidly over the entire Rocky Mountain region with appalling human suffering and loss of livestock.

#### GENERAL ADMINISTRATION

During the past four years the general administrative staff of the department has been materially strengthened. A budget officer has been appointed to supervise and coordinate the fiscal and business affairs of the department and to assist in the preparation and handling of the department budget as provided by the budget and accounting act. Participating in the fixed policy of the Government in this respect, notable advances have been made in improving the business administration of the department. A director of purchase and sales has been appointed to supervise and coordinate the procurement of supplies and services for the department and to supervise the disposition of surplus property in the several branches. A traffic manager has been appointed to function in a similar manner in connection with all transportation matters. Representatives of the department have been assigned to the various boards set up under the Bureau of the Budget, including the traffic board, the purchasing board, the real estate board, the joint conference on printing, the board of contracts and adjustments, the specifications board, and other similar agencies. Radical departures in business procedure have been adopted, but these have involved nothing more than the correct application of modern business methods to the work of the department, with the thought always in mind of getting full value received for the expenditure of every dollar of the taxpayers' money.

The highest commendation is due the personnel of the department for the spirit in which they have entered into the plan to conduct the business of the Government on the most economical and efficient basis possible. I have found on every hand a full appreciation of the fact that every dollar spent had to be earned by

some one and that its expenditure under our management must always be with that fact clearly in mind.

Further progress needs to be made in the improvement of the general business administration. A review of the results accomplished during the past four years indicates conclusively that for every dollar additional expended in strengthening the general administration many dollars more are saved to the Government in increased efficiency and specific economies effected. In order to establish a sound basis for greater advance along this line, the United States Bureau of Efficiency recently, at the request of the department, assigned a trained investigator to make a study of the general business organization with a view to suggest such further changes as may appear beneficial.

#### PERSONNEL OF THE DEPARTMENT

The personnel of the department on June 30, 1924, numbered approximately 20,000, of whom 5,000 were located in Washington and 15,000 were engaged in work outside of Washington. The turnover in the personnel during the fiscal year 1924 was 13.81 per cent, or 2.32 per cent less than for the preceding year.

The duty of coordinating and supervising the intricate work incident to the classification of the department personnel has continued to be discharged by the personnel classification officer specially appointed for this purpose a year ago. The salary classification act became effective July 1, 1924. By its terms it applies only to the personnel in the District of Columbia. As a result of the operations of this law, 79 of the employees of the department in Washington on July 1, 1924, suffered reductions in compensation; in 1,436 cases the salaries remained unchanged, and the remainder received moderate salary increases. The average salary increase under the classification act for the total number of employees in Washington was 4.56 per cent. The classification of employees of the department as made effective July 1, 1924, has not eliminated all disparities in compensation. Under the provisions of the act, however, which make possible advancement in salary within the various grades on the basis of merit, it is hoped that within a reasonable time equitable and satisfactory adjustments may be made.

The employment situation in the department has been vastly improved by the adjustments under the classification act and by the better opportunities presented for advancement under the provisions of the act, assuming funds will be made available for this purpose from time to time. Certain details which have developed in connection with the administration of the act as applied to actual working problems present the need for changes which doubtless will be made as conditions permit. Provision should be made for the employ-



ment where needed of at least a limited number of experts in special scientific and technical problems at salaries higher than now is permitted for this purpose.

In addition to the benefits under the salary classification act the personnel situation has been improved by the application of the retirement act. The status of the civil service in this department would be improved if the provisions of the retirement act were amended so as to assure the payment of a larger annuity to employees who become eligible for retirement from the higher grades. At present all employees have  $2\frac{1}{2}$  per cent deducted from their salaries for the purpose of annuity, but the maximum annuity is \$720 per annum regardless of whether the deduction has been made from a salary of \$1,200 or from a salary of \$6,000 per annum. Retirement from the military branches of this Government and retirement from the civil branches of certain foreign governments is on a basis which takes into account the grade of the employee concerned, and in the present case it would seem altogether reasonable to apply the same principle, since the employees themselves contribute the funds from which the annuities are paid. Modification of the retirement act in this way would make the Federal service more attractive as a career for the outstanding men in scientific research.

Further improvement in the personnel situation has been effected by the establishment in the department under the director of scientific work of a graduate school for research workers and by the department making it possible for men engaged in scientific work to take advanced work on the problems in which they are engaged at the various universities without separating themselves from the department service. The proper development of the personnel work of the department, especially in view of the present procedure involved under the salary classification act, in the matter of efficiency ratings, etc., represents one of the most important branches of our general administration, and it is contemplated that increased attention will need to be given to this work in the future, preferably under an officer of the department who will function as director of personnel.

#### HOUSING SITUATION SERIOUS

In previous reports attention has been called to the deplorable housing situation of this department and the need for action as soon as feasible to improve it. Of the more than 40 buildings occupied in various parts of Washington, some of them at considerable distance from the department, to which reference was made in the annual reports for 1922 and 1923, none have been abandoned. On

the contrary, two additional locations were necessary in order to handle the work.

In the study of administrative operations the department constantly finds that costs are excessive because of the number and scattered locations of the buildings occupied. Almost inestimable savings and increased efficiency could be effected if the department were housed in fewer buildings more closely related to the central administration, with consequent greater ease of intercommunication, closer supervision, and lessening of expense for guarding, cleaning, messenger service, and trucking service. Unquestionably this is the greatest need of the department at the present time. Conferences recently have been held with the chairman of the Fine Arts Commission and the architects who planned the buildings of the department constructed in 1908, as a result of which revised sketches have been made and a rough estimate submitted covering the construction of a central unit to join the two wings already completed. Nothing will be more helpful to the department than the resumption of the building program, which I hope will be possible during the coming year.

#### APPROPRIATIONS

As in past years, a summary of the department appropriations appears at the end of this report. An analysis of the regular appropriations of the department for the fiscal year 1924 indicates that about one-half of the money was spent for regulatory and service work which is conducted not alone in the interest of the producers on the farm but for the benefit of all classes of our citizens. The maintenance of the national forests and the Federal meat inspection are typical activities in this group. On the other hand, less than one-fourth of the funds available for the ordinary activities of the department, or approximately \$9,700,000, was available for scientific research. During the past four years the basic importance of agricultural research, upon the results of which the success of the department's other activities is dependent, has been particularly stressed in these reports. The funds annually provided for this purpose, however, have not increased materially during this period. A type of work which has yielded such vast additions to our national welfare is deserving of the most liberal financial support from the Government. The money so used may be regarded as in the nature of an investment in the national interest, from which, in the light of past experience, continuous returns to the public in value greatly exceeding the outlay may be expected.

Adequate expansion of the department's activities has been effected by the policy of retrenchment in Government expenditures necessarily adopted at the close of the war. This is a service and creative

department. It should keep pace with the country's agricultural and industrial development and with the changing needs of our complex population, constituting as it does an integral and inevitable part of this development. The amount involved for all the activities of the department, except Federal aid to the States in road construction, is much less than 2 per cent of the total expenditures of the Government, and adequate support of the basic scientific research work would not materially alter this ratio. As the fiscal situation of the Government permits growing, support should be given to these activities.



## REVIEW OF AGRICULTURAL PRODUCTION AND EXPORTS

*Area of crops in the United States*

[Thousands of acres; i. e., 000 omitted.]

Crop	Annual average 1910-1914	1915	1916	1917	1918	1919	1920	1921	1922	1923 <sup>1</sup>	1924 <sup>2</sup>
<b>CEREALS</b>											
Corn.....	105,240	106,197	105,296	116,730	104,467	97,170	101,699	103,740	102,846	104,158	105,604
Wheat.....	48,953	60,419	52,316	45,089	59,181	75,694	61,143	63,696	62,317	58,308	53,818
Oats.....	38,014	40,096	41,527	43,553	43,340	40,359	42,491	45,495	40,790	40,833	41,625
Barley.....	7,593	7,148	7,757	8,933	9,740	6,720	7,600	7,414	7,317	7,905	7,558
Rye.....	2,365	3,129	3,213	4,317	6,391	6,307	4,409	4,528	6,372	5,157	4,337
Buckwheat.....	826	769	828	924	1,027	1,700	701	680	764	794	794
Rice.....	733	803	869	981	1,119	1,063	1,336	921	1,055	892	899
Grain sorghums.....		4,153	3,944	5,153	6,036	5,060	5,120	4,635	5,064	5,776	5,450
Total.....	203,664	223,664	215,750	225,680	232,310	233,073	224,499	231,109	226,825	223,766	220,094
<b>VEGETABLES</b>											
Potatoes.....	3,686	3,734	3,565	4,384	4,295	3,542	3,657	3,941	4,307	3,816	3,753
Sweet potatoes.....	611	731	774	919	940	941	992	1,066	1,117	990	993
Beans (commercial).....		928	1,107	1,821	1,744	1,090	847	777	1,078	1,322	1,393
Onions (commercial).....				65	65	53	65	57	63	61	60
Cabbage (commercial).....				93	112	92	119	100	132	98	
Total.....	4,297	5,393	5,446	7,282	7,156	5,088	5,680	5,941	6,697	6,290	
<b>MISCELLANEOUS</b>											
Cranberries (3 States).....		23	26	18	25	25	25	25	25	25	22
Flaxseed.....	2,402	1,387	1,474	1,984	1,910	1,503	1,757	1,108	1,113	2,061	3,375
Sugar beets.....	488	611	665	665	594	692	872	815	917	657	917
Tobacco.....	1,209	1,370	1,413	1,518	1,637	1,951	1,960	1,427	1,695	1,842	1,702
All hay.....	66,356	67,904	72,356	71,415	71,120	74,038	73,888	74,401	77,030	75,884	77,000
Cotton.....	35,330	31,412	34,985	33,841	36,008	33,566	35,878	30,509	33,036	37,123	40,493
Sorghum cane for sirup.....				415	368	487	536	518	447	380	386
Peanuts.....			1,043	1,842	1,865	1,181	1,214	1,214	1,005	884	950
Broomcorn.....		230	335	345	366	352	276	222	275	498	438
Clover seed.....			939	821	820	942	1,082	889	1,156	800	
Grand total.....	313,756	331,994	334,333	345,826	354,243	353,449	347,634	348,178	349,834	350,210	

<sup>1</sup> Subject to revision in December.<sup>2</sup> Preliminary.

*Crop production in the United States*

[Thousands; i. e., 000 omitted.]

Crop	Annual average 1910-1914	1915	1916	1917	1918	1919	1920	1921	1922	1923 <sup>1</sup>	1924 <sup>2</sup>
<b>CEREALS</b>											
Corn.....bushels.....	2,732,457	2,994,793	2,566,927	3,065,233	2,502,065	2,811,302	3,208,584	3,068,569	2,906,020	3,046,387	2,512,888
Wheat.....do.....	728,225	1,025,801	636,318	636,655	921,438	967,979	833,027	814,905	867,598	785,741	837,000
Oats.....do.....	1,557,961	1,549,030	1,526,124	1,528,124	1,528,124	1,184,030	1,496,281	1,078,341	1,215,803	1,299,823	1,486,412
Barley.....do.....	186,208	228,851	182,309	211,759	256,225	147,608	189,332	154,946	182,068	198,185	194,445
Rye.....do.....	37,568	54,050	48,862	62,933	91,041	75,483	60,490	61,675	103,362	63,023	65,800
Buckwheat.....do.....	17,022	15,056	11,052	16,022	16,905	14,399	13,142	14,207	14,564	13,920	15,152
Rice.....do.....	24,378	28,947	40,861	34,739	38,006	41,985	52,065	37,612	41,405	33,256	32,377
Grain sorghums.....do.....	114,460	114,460	53,858	61,409	73,241	130,734	137,408	113,990	90,524	105,619	125,968
Total.....	4,883,819	6,010,988	4,792,634	5,681,490	5,438,245	5,373,520	5,990,330	5,344,245	5,421,344	5,545,954	5,270,042
<b>VEGETABLES</b>											
Potatoes.....bushels.....	360,772	359,721	286,953	442,108	411,860	322,807	403,296	361,659	453,396	412,392	412,761
Sweet potatoes.....do.....	57,117	75,639	70,955	83,822	87,924	97,126	103,925	98,654	109,394	97,177	74,995
Beans (commercial).....do.....	.....	10,321	10,715	16,045	17,397	13,319	9,185	9,150	12,793	16,030	12,423
Onions (commercial).....do.....	.....	7,664	8,562	12,376	19,621	14,548	21,343	14,165	18,763	16,318	17,570
Cabbage (commercial).....do.....	.....	671	255	475	842	614	1,062	654	1,063	740	.....
<b>FRUITS</b>											
Peaches.....bushels.....	45,842	64,097	37,505	48,705	33,094	53,178	45,620	32,602	55,852	45,702	51,686
Pears.....do.....	11,184	11,216	11,874	13,281	13,362	15,006	16,805	11,297	20,705	17,390	17,278
Apples.....do.....	197,898	230,011	193,905	166,749	169,625	142,086	223,677	99,002	202,702	196,770	178,640
Cranberries (3 States).....do.....	.....	441	471	249	352	549	449	384	560	610	541
<b>MISCELLANEOUS</b>											
Flaxseed.....bushels.....	18,353	14,020	14,296	9,164	13,369	7,178	10,752	8,029	10,375	17,429	29,029
Sugar beets.....tons.....	5,491	6,511	6,228	5,980	5,919	6,421	8,538	7,782	5,183	7,006	7,070
Tobacco.....pounds.....	991,958	1,062,237	1,153,278	1,249,276	1,439,071	1,465,481	1,582,225	1,069,693	1,246,837	1,491,066	1,195,059
All hay.....tons.....	81,640	107,263	110,992	98,439	91,139	104,700	105,315	97,770	112,013	106,626	.....
Cotton.....bales.....	14,259	11,132	11,450	11,302	12,041	11,421	13,440	7,954	9,762	10,128	12,787
Sorghum sirup.....gallons.....	14,974	14,823	13,668	37,472	33,387	39,413	49,505	45,566	36,440	32,001	28,439
Peanuts.....pounds.....	.....	919,028	1,432,581	1,432,581	1,240,102	783,271	841,474	829,307	633,114	636,462	614,629
Broomcorn.....tons.....	52	52	39	57	57	53	36	38	37	69	79
Clover seed.....bushels.....	.....	.....	1,706	1,488	1,197	1,484	1,944	1,538	1,887	1,233	1,205

<sup>1</sup> Subject to revision in December.<sup>2</sup> Preliminary, Sept. 1.

## Exports of domestic foodstuffs and cotton from the United States

[Foreign Commerce and Navigation of the United States, 1910-1918, and monthly summaries of the Bureau of Foreign and Domestic Commerce, June, 1921, 1922, 1923, and 1924]

Article exported	Unit	Year ended June 30—										
		Average 1910-1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
		Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands	Thousands
Wheat, including flour	Bushel	104,967	332,465	243,117	203,574	132,579	287,402	219,865	366,077	279,407	221,923	156,430
Corn, including meal	do	41,409	50,668	39,897	66,753	49,073	32,019	16,729	70,906	173,490	96,586	23,135
Oats, including oatmeal	do	9,655	100,609	98,960	95,106	125,091	109,005	43,456	9,391	21,237	25,413	8,796
Barley, excluding flour	do	7,896	26,755	27,473	16,381	26,285	20,458	26,571	20,457	22,400	18,193	11,209
Rye, including flour	do	888	13,027	15,250	13,703	17,186	36,467	41,531	47,337	29,944	51,663	19,902
Rice, including flour, meal, and broken rice	Pound	18,489	75,449	120,695	181,372	196,363	193,128	483,385	440,855	741,509	370,670	227,757
Dairy products:												
Butter	do	4,278	9,851	13,487	26,835	17,736	33,740	27,156	7,829	7,512	9,410	5,425
Cheese	do	4,915	55,363	44,394	66,050	44,303	18,792	19,378	10,826	7,471	8,446	3,938
Milk, condensed, evaporated, and powdered	do	15,774	37,236	159,578	259,141	528,759	728,740	710,533	266,506	288,629	159,957	216,319
Total dairy products	do	24,967	102,450	217,459	352,026	590,798	781,272	757,067	285,161	303,612	177,812	225,082
Meat and meat products:												
Pickled beef	do	32,873	31,875	38,114	58,054	54,468	45,065	32,384	23,313	26,774	24,185	21,851
Fresh beef	do	29,452	170,441	231,214	197,177	370,033	332,205	133,561	21,084	3,993	4,017	2,817
Canned beef	do	9,392	75,243	50,804	67,536	97,343	108,460	31,133	10,763	3,749	2,312	1,592
Total beef	do	71,717	277,559	320,132	322,767	521,844	485,730	217,078	55,160	34,516	30,514	26,260
Bacon	do	182,474	346,718	579,809	667,152	815,294	1,238,247	803,667	489,298	350,549	408,334	423,500
Hams and shoulders	do	166,813	203,701	282,208	266,656	419,572	667,240	275,456	172,012	271,642	319,269	381,564
Pickled pork	do	48,275	45,656	63,461	46,993	33,222	31,504	41,643	33,286	33,510	40,934	37,469
Canned pork	do	4,227	9,611	5,286	5,896	5,195	5,273	3,262	1,119	2,263	2,699	2,725
Fresh pork	do	2,024	3,908	63,005	50,436	21,390	19,645	27,225	57,075	25,911	43,772	49,113
Total pork	do	403,813	604,628	998,094	1,037,133	1,294,673	1,961,909	1,151,253	752,790	683,875	815,008	894,371
Mutton and lamb	do	3,539	3,877	5,553	3,196	2,098	2,174	3,958	7,255	2,502	1,769	1,633
Lard and neutral lard	do	1,517,927	501,553	461,438	462,346	396,765	742,167	610,427	768,702	831,952	979,136	1,039,137
Oleo oil	do	2116,225	80,482	102,646	67,110	56,603	59,292	74,529	106,415	117,174	104,956	92,965
Tallow	do	29,009	20,240	16,289	15,209	5,015	16,172	23,937	16,844	27,658	25,665	37,372
Other meat products	do	115,019	125,895	104,617	98,963	69,894	190,634	134,750	107,473	102,312	63,589	64,446
Total meat and meat products	do	1,257,249	1,614,234	2,008,771	2,006,724	2,346,834	3,458,078	2,224,932	1,814,638	1,799,989	2,020,637	2,156,184



Apples <sup>1</sup> .....	Barrel.....	1,551	2,352	1,466	1,740	635	1,576	1,051	2,665	1,094	1,756	4,098
Cotton.....	500-pound bale.....	8,840	8,807	6,168	6,176	4,611	5,526	7,087	5,623	6,718	5,253	5,899
Tobacco, leaf (including stems and trimmings).....	Pound.....	392,183	348,346	443,293	411,599	289,171	629,288	648,038	506,526	463,389	454,364	597,630
Total agricultural exports, including forest products.....	Dollar.....	1,143,642	1,528,491	1,586,227	2,037,172	2,367,647	3,693,193	4,051,560	2,749,518	2,009,981	1,929,150	2,029,686
Total agricultural exports, excluding forest products.....	do.....	1,038,041	1,475,938	1,518,071	1,908,253	2,280,466	3,579,918	3,861,511	2,007,642	1,915,866	1,799,168	1,866,897
Index of volume of exports, excluding forest products.....	Index No.....	100	138	118	118	101	145	134	127	137	112	104

<sup>1</sup> Five-year average for lard and four-year average for neutral lard; neutral lard included with "oleo oil" in 1910.

<sup>2</sup> Includes neutral lard for 1910.

<sup>3</sup> Includes boxed apples, boxes reduced to barrels on the basis of three boxes to the barrel.

## FINANCIAL STATEMENT

The net cost to the Federal Government of the regular activities of the department during the fiscal year 1924 was approximately \$36,900,000, as indicated by the following table:

## FEDERAL FUNDS FOR REGULAR WORK OF DEPARTMENT

	Appropriations available, fiscal year 1924	Expenditures, fiscal year 1924	Outstanding obligations, June 30, 1924	Unobligated balances
Agricultural appropriation act, 1924 (exclusive of appropriations made direct to States for research work under the Hatch and Adams Acts and for extension work under the Smith-Lever Act, and appropriations for the acquisition of lands by the National Forest Reservation Commission, for Federal highway and forest road and trail construction, for collection of seed-grain loans made to farmers in drought-stricken areas, and for printing and binding for congressional distribution publications on diseases of the horse and diseases of cattle)-----	\$33,826,653.00	\$29,308,434.94	\$3,640,833.50	\$877,384.56
Deficiency appropriation acts (Apr. 2, 1924, and Apr. 26, 1924)-----	2,675,950.00	1,251,675.48	1,417,208.98	7,065.54
Supplemental appropriation for increase of compensation (act of Mar. 4, 1923)-----	3,304,800.00	2,944,564.82	234,454.03	125,781.15
Permanent annual appropriation for meat inspection (act of June 30, 1906)-----	3,000,000.00	2,669,213.79	219,521.85	111,264.36
Revolving fund for classification of cotton-----	145,823.07	80,151.26		65,671.81
Revolving fund for sale of cotton standards-----	1,326.40	30.30		1,296.10
Allotment for fixed nitrogen research (unexpended balance of allotment previously transferred from appropriation placed at disposal of the President by the national defense act of June 3, 1916)-----	562,927.29	194,737.10	5,587.54	362,502.65
Eradication of foot-and-mouth and other contagious diseases of animals (reappropriation of unexpended balance from 1923)-----	300,532.44	298,725.82	1,806.62	
Boll-weevil poisoning through use of airplanes (available balance of appropriation made for the fiscal years 1923 and 1924)-----	10,792.46	7,640.49	3,150.17	1.60
Investigating sources of crude rubber (available balance of appropriation made for the fiscal years 1923 and 1924)-----	95,604.43	61,246.85	33,944.82	412.76
Control of white-pine blister rust (available balance of continuing appropriation made in 1922)-----	4,850.40	830.06	36.55	3,983.79
Control of insect infestations on national forests (available balance of continuing appropriation made in 1922)-----	69,810.95	27,596.76	13,255.12	28,959.07
Other continuing appropriations for regular work-----	81,937.84	6,366.33	1,154.38	74,417.13
Total-----	44,081,008.28	36,851,214.00	5,570,953.56	1,658,840.72
Expenditures, as shown above-----				\$36,851,214.00
Outstanding obligations, as shown above-----				5,570,953.56
Total expenditure for year when all obligations are paid-----				42,422,167.56
Less:				
Receipts, 1924, deposited in United States Treasury to credit of miscellaneous receipts fund (see below)-----			\$5,426,953.54	
Reimbursement by dealers for cost of classifying cotton-----			91,572.41	
				5,518,525.95
Net cost of regular work-----				36,903,641.61

Of the total expenditure of \$42,400,000 for the regular work of the department, approximately \$9,700,000, or 22.9 per cent, was used for research; \$2,400,000, or 5.7 per cent, for extension; \$20,000,000, or 47.1 per cent, for service and regulatory activities; and \$10,800,000,

or 24.3 per cent, for the direct eradication or control of various animal and plant diseases and pests.

**DIRECT INCOME TO GOVERNMENT IN CONNECTION WITH WORK OF  
DEPARTMENT OF AGRICULTURE, FISCAL YEAR 1924**

Incident to the department's work during the fiscal year 1924, direct receipts aggregating \$10,065,160.28 were covered into the Treasury, and fines were imposed and judgments recovered by the courts amounting to \$157,536.60 in connection with the enforcement by the department of the regulatory acts which devolve upon it for administration and execution, as follows:

Receipts:

Deposited to credit of miscellaneous receipts  
fund—

From business on the national forests__	\$4, 731, 163. 19
From other sources_____	695, 790. 35

\$5, 426, 953. 54

Deposited to credit of miscellaneous receipts  
fund but subsequently appropriated as spe-  
cial funds for use of Forest Service—

10 per cent of net receipts from busi- ness on the national forests, for forest road and trail construction in 1925__	520, 739. 92
---	--------------

Contributions from private sources, used mainly for the construction of forest roads and trails_____	2, 618, 441. 59
--	-----------------

3, 139, 181. 51

Deposited to credit of appropriations for regular work of  
department\_\_\_\_\_

494, 971. 24

Deposited to credit of appropriations admin-  
istered by but not used in prosecuting  
regular work of department—

Reimbursement for cost of distributing surplus war materials to States for use in road-construction work_____	781, 745. 60
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Repayments by farmers of seed grain loans_____	222, 308. 39
---	--------------

1, 004, 053. 99

Total receipts\_\_\_\_\_

10, 065, 160. 28

Fines imposed and judgments recovered by the courts in con-  
nection with violations of statutes intrusted to Department  
of Agriculture for enforcement\_\_\_\_\_

157, 536. 60

Total direct income to Government resulting from activi-  
ties of Department of Agriculture\_\_\_\_\_

10, 222, 696. 88

**FEDERAL FUNDS ADMINISTERED BY DEPARTMENT BUT NOT USED FOR  
ITS REGULAR WORK**

In addition to the expenditures for conducting the investigative, regulatory, and other regular activities of the department, \$102,-051,027.36 was expended during the fiscal year 1924 from appropria-



tions administered by the department other than those used for the prosecution of its regular work, as follows:

	Appropriation available, fiscal year 1924	Expenditure, fiscal year 1924	Unexpended balance, June 30, 1924
Extension work in agriculture and home economics:			
Provided by Smith-Lever Act of May 8, 1914-----	\$4, 580, 000. 00		
Supplementary fund pro- vided by agricultural appropriation act for 1924-----	1, 300, 000. 00		
Balances from prior years--	175, 601. 05		
	6, 055, 601. 05	<sup>1</sup> \$5, 820, 816. 89	\$234, 784. 16
Research work of State agri- cultural experiment stations (provided by agricultural appropriation act for 1924) -	1, 440, 000. 00		
Balances from prior years----	8. 49		
	1, 440, 008. 49	<sup>1</sup> 1, 440, 000. 41	8. 08
Federal-aid road construction (provided by acts of July 11, 1916; Feb. 28, 1919; Nov. 9, 1921; Jan. 22, 1923; and Feb. 26, 1923) :			
Rural post roads—			
Appropriated for fiscal year 1924-----	29, 300, 000. 00		
Balances from prior years-----	132, 079, 279. 99		
	161, 379, 279. 99	80, 380, 925. 10	80, 998, 354. 89
Roads and trails within or adjacent to national forests—			
Appropriated for fis- cal year 1924-----	4, 000, 000. 00		
Ten per cent of na- tional forest receipts for 1923, available for road and trail building in 1924---	528, 569. 06		
Balances from prior years-----	11, 279, 523. 79		
	15, 808, 092. 85	9, 252, 120. 99	6, 555, 971. 86
Payments to States from na- tional forest receipts for ben- efit of county schools and roads -----	1, 371, 550. 15	<sup>1</sup> 1, 371, 550. 15	

<sup>1</sup> Paid direct to States by Treasury Department.

	Appropriation available, fiscal year 1924	Expenditure, fiscal year 1924	Unexpended balance, June 30, 1924
Refunds to users of national forest resources of moneys deposited by them in excess of amounts required to secure purchase price of timber, use of lands, etc-----	\$115, 085. 38	\$115. 085. 38	
Acquisition of lands by National Forest Reservation Commission for protection of forested watersheds of navigable streams:			
Provided by agricultural appropriation act for 1924-----	450, 000. 00		
Balances from prior years--	1, 140, 063. 51		
	1, 590, 063. 51	866, 819. 21	\$723, 244. 30
Expenses of National Forest Reservation Commission (provided by act of Mar. 1, 1911):			
Appropriation for fiscal year 1924-----	25, 000. 00		
Balances from prior years--	49, 277. 36		
	74, 277. 36	321. 31	73, 956. 05
Cooperative work, Forest Service, consisting principally of forest road and trail construction (paid from contributions from private sources):			
Amount contributed during 1924-----	2, 618, 441. 59		
Balances from prior years--	599, 180. 33		
	3, 217, 621. 92	2, 221, 962. 72	995, 659. 20
Loans to farmers in drought-stricken areas:			
Appropriation provided by joint resolution of Apr. 26, 1924, for seed and feed loans to farmers in New Mexico-----	1, 000, 000. 00		
Appropriations provided by agricultural act for 1924 and deficiency act of Apr. 2, 1924, for collection of loans-----	33, 000. 00		

	Appropriation available, fiscal year 1924	Expenditure, fiscal year 1924	Unexpended balance, June 30, 1924
Loans to farmers in drought- stricken areas—Continued.			
Balance of appropriation provided by deficiency act of Mar. 4, 1923, for collection of loans -----	\$5, 773. 34		
Collections during 1924 of loans made in 1921 and 1922-----	222, 308. 39		
Previously collected-----	2, 081, 368. 04		
	3, 342. 449. 77	\$410, 881. 56	\$2, 931, 568. 21
Work done by Department of Agriculture for other depart- ments at their request, under authority of sec. 7, fortifica- tions act of May 21, 1920:			
Allotments from other de- partments, fiscal year 1924-----	72, 860. 00		
Balance of allotments made in prior years----	1, 886. 73		
	74, 746. 73	70, 543. 64	4, 203. 09
Printing and binding, for con- gressional distribution, pub- lications on Diseases of the Horse and Diseases of Cattle (provided by the agricul- tural act for 1924) -----	200, 000. 00	100, 000. 00	100, 000. 00
Total Federal appropria- tions administered by department but not used for its regular work-----	194, 668, 777. 20	102, 051, 027. 36	92, 617, 749. 84

**SUMMARY OF ALL APPROPRIATIONS AVAILABLE TO DEPARTMENT DURING FISCAL YEAR 1924**

	Appropriation available, fis- cal year 1924	Expenditure, fiscal year 1924	Unexpended balance, June 30, 1924
Federal funds for regular work of department during fiscal year 1924-----	\$44, 081, 008. 28	\$36, 851, 214. 00	\$7, 229, 794. 28
Federal funds administered by department but not used for its regular work-----	194, 668, 777. 20	102, 051, 027. 36	92, 617, 749. 84
Total for work of fiscal year 1924-----	238, 749, 785. 48	138, 902, 241. 36	99, 847, 544. 12
Federal funds remaining available for payment of out- standing obligations incurred in conducting regular work of department during fiscal years 1922 and 1923----	7, 001, 980. 09	4, 155, 706. 19	2, 846, 273. 90
Total-----	245, 751, 765. 57	143, 057, 947. 55	102, 693, 818. 02

<sup>1</sup> Including \$5,570,953.56 for outstanding obligations, as of June 30, 1924.



*Statement of appropriations, expenditures, and balances for fiscal year 1924*

Title of appropriation	Amount appropriated	Expenditures to June 30, 1924	Unexpended balance, June 30, 1924	Amount turned into surplus fund	Balance available for fiscal year 1925
Appropriations and funds for fiscal year 1924:					
Agricultural appropriation act for fiscal year 1924 (exclusive of \$29,300,000 for rural post roads and \$3,000,000 for forest roads, shown below)	\$37,236,653.00	\$32,311,707.45	\$4,924,945.55	-----	\$4,924,945.55
Supplemental appropriations made in deficiency act of Apr. 2, 1924, and joint resolution of Apr. 26, 1924—					
Eradication of foot-and-mouth disease	2,500,000.00	1,172,439.51	1,327,560.49	-----	1,327,560.49
Farmers' seed and feed loans, New Mexico	1,000,000.00	378,805.17	621,194.83	-----	621,194.83
Preventing spread of moths	70,000.00	1,148.69	68,851.31	-----	68,851.31
Fighting forest fires	55,000.00	55,000.00		-----	
Protection of lands in Oregon and California railroad forfeiture suits	11,900.00	2,429.90	9,470.10	-----	9,470.10
Enforcement of cotton standards act	25,550.00	17,157.38	8,392.62	-----	8,392.62
Administration of warehouse act	10,000.00	-----	10,000.00	-----	10,000.00
Experiment station, Island of Guam	3,500.00	3,500.00	-----	-----	-----
Collection of seed-grain loans	13,000.00	7,628.51	5,371.49	-----	5,371.49
Supplemental appropriation for increase of compensation (act of Mar. 4, 1923)	3,304,800.00	2,944,564.82	360,235.18	-----	360,235.18
Permanent specific appropriations—					
Meat inspection (act of June 30, 1906)	3,000,000.00	2,669,213.79	330,786.21	-----	330,786.21
Cooperative agricultural extension work (act of May 8, 1914)	4,580,000.00	4,520,816.89	59,183.11	-----	59,183.11
Cooperative construction of roads and trails, national forests (act of July 11, 1916)	1,000,000.00	-----	1,000,000.00	-----	1,000,000.00
National Forest Reservation Commission (act of Mar. 1, 1911)	25,000.00	315.27	24,684.73	-----	24,684.73
Continuing appropriations—					
Cooperative construction of rural post roads (agricultural act, fiscal year 1924)	29,300,000.00	-----	29,300,000.00	-----	29,300,000.00
Forest highways (agricultural act, fiscal year 1924)	1,500,000.00	-----	1,500,000.00	-----	1,500,000.00
Forest road development (agricultural act, fiscal year 1924)	1,500,000.00	625,707.88	874,292.12	-----	874,292.12
Indefinite appropriations and funds—					
Refunds to depositors, national forests fund	115,085.38	115,085.38	-----	-----	-----
Roads and trails for States, national forests fund	528,569.06	27,424.03	501,145.03	-----	501,145.03
Payments to States and Territories, national forests fund	1,321,422.66	1,321,422.66	-----	-----	-----
Payments to school funds, Arizona and New Mexico, national forests fund	50,127.49	50,127.49	-----	-----	-----
Cooperative work, Forest Service	2,618,441.59	1,622,782.39	995,659.20	-----	995,659.20
Revolving fund for classification of cotton	91,572.41	25,900.60	65,671.81	-----	65,671.81

*Statement of appropriations, expenditures, and balances for fiscal year 1924—*  
Continued

Title of appropriation	Amount appropriated	Expenditures to June 30, 1924	Unexpended balance, June 30, 1924	Amount turned into surplus fund	Balance available for fiscal year 1925
<b>Appropriations and funds for fiscal year 1924—Continued.</b>					
Indefinite appropriations and funds—Continued.					
Revolving fund for sales of cotton standards..	\$1,326.40	\$30.30	\$1,296.10	-----	\$1,296.10
Fund from seed-grain loans collected during 1924 .....	222,308.39	23.79	222,284.60	\$110,002.39	112,282.21
Allotments from other departments:					
Collecting statistics, Bureau of Census.....	5,000.00	2,829.91	2,170.09	-----	2,170.09
Air Service, Army.....	10,000.00	9,795.32	204.68	-----	204.68
Breeding experimental animals, Army.....	850.00	727.20	122.80	-----	122.80
Investigations for Federal Power Commission.....	1,010.00	1,000.04	9.96	-----	9.96
Aviation, Navy.....	55,000.00	53,637.06	1,362.94	-----	1,362.94
Construction and repair, Navy.....	1,000.00	982.75	17.25	-----	17.25
Total, current appropriations and funds (exclusive of balances from prior years).....	90,157,116.38	47,942,204.18	42,214,912.20	110,002.39	42,104,909.81

Title of appropriation	Amount available for fiscal year 1924	Expenditures during fiscal year 1924	Unexpended balance, June 30, 1924	Amount turned into surplus fund	Balance available for fiscal year 1925
<b>Unexpended balances of appropriations and funds for prior fiscal years remaining available for expenditure or other disposition during fiscal year 1924:</b>					
Appropriations in agricultural act for fiscal year 1922.....	\$1,947,055.19	\$558,907.48	\$1,388,147.71	\$1,388,147.71	-----
Appropriations in agricultural act for fiscal year 1923.....	5,385,836.03	3,980,216.63	1,405,619.40	-----	\$1,405,619.40
Reappropriation of unexpended balance for eradication of foot-and-mouth disease, etc.....	300,532.44	298,725.82	1,806.62	-----	1,806.62
Reappropriation of Federal-aid road administrative funds for road-materials investigations.....	22,488.72	12,455.66	10,033.06	10,033.06	-----
Supplemental appropriations for fiscal years 1922 and 1923:					
White-pine blister rust control.....	4,850.40	830.06	4,020.34	-----	4,020.34
Insect infestations, national forests.....	69,810.95	27,596.76	42,214.19	-----	42,214.19
Enforcement of packers and stockyards act.....	26,913.66	105.18	26,808.48	26,808.48	-----
Enforcement of future trading act.....	27,311.41	-----	27,311.41	27,311.41	-----
Operation of Center Market.....	22,332.66	203.43	22,129.23	22,129.23	-----
Salaries and expenses, wool division, War Industries Board.....	2,500.00	-----	2,500.00	2,500.00	-----
Protection of lands in Oregon and California railroad forfeiture suits.....	2,492.39	-----	2,492.39	2,492.39	-----
Motor boat for Alaskan forests.....	8,500.00	8,500.00	-----	-----	-----
Investigating sources of crude rubber.....	95,604.43	61,246.85	34,357.58	-----	34,357.58

*Statement of appropriations, expenditures, and balances for fiscal year 1924—*  
Continued

Title of appropriation	Amount available for fiscal year 1924	Expenditures during fiscal year 1924	Unexpended balance, June 30, 1924	Amount turned into surplus fund	Balance available for fiscal year 1925
Unexpended balances of appropriations and funds for prior fiscal years remaining available for expenditure or other disposition during fiscal year 1924—Con.					
Supplemental appropriations for fiscal years 1922 and 1923—Continued.					
Boll-weevil poisoning through use of airplanes	\$10,792.46	\$7,640.49	\$3,151.97	-----	\$3,151.97
Preventing spread of Japanese beetle	6,268.71	5,975.48	293.23	-----	293.23
Collection of seed-grain loans	5,773.34	4,424.09	1,349.25	-----	1,349.25
Consolidating addressing and duplicating work	33.94	-----	33.94	\$33.94	-----
Blowdown of timber, Olympic National Forest	8,421.63	-----	8,421.63	8,421.63	-----
Supplemental appropriation for increase of compensation for fiscal year 1923	297,000.04	207,314.21	89,685.83	-----	89,685.83
Unexpended balances of permanent specific appropriations for fiscal years 1922 and 1923—					
Meat inspection	108,899.53	6.93	108,892.60	108,892.60	-----
Cooperative agricultural extension work	175,601.05	-----	175,601.05	106,050.50	69,550.55
Cooperative construction of roads and trails, national forests	1,484,820.31	1,057,671.20	427,149.11	-----	427,149.11
National Forest Reservation Commission	49,277.36	6.04	49,271.32	24,774.05	24,497.27
Unexpended balances of continuing appropriations for 1923, 1922, and prior fiscal years—					
Cooperative construction of rural post roads	132,079,279.99	80,380,925.10	51,698,354.89	-----	51,698,354.89
Forest highways	6,657,495.47	4,608,436.45	2,049,059.02	-----	2,049,059.02
Forest road development	2,140,080.78	2,140,080.78	-----	-----	-----
Federal forest road construction	475,746.18	271,419.60	204,326.58	-----	204,326.58
Acquisition of lands for protection of forested watersheds of navigable streams	275,998.18	105,568.30	170,429.88	-----	170,429.88
Enforcement of grain standards act	1,063.59	160.89	902.70	-----	902.70
Administration of warehouse act	525.94	309.76	216.18	-----	216.18
Determining cotton standards and spot markets	234.81	200.00	34.81	-----	34.81
Sullys Hill National Park game preserve	4,494.19	4,494.19	-----	-----	-----
Wind Cave National Park game preserve	1,241.52	1,201.49	40.03	-----	40.03
Laboratory building for Bureau of Public Roads, Arlington farm	74,377.79	-----	74,377.79	-----	74,377.79
Unexpended balances of indefinite appropriations and funds for 1923, 1922, and prior fiscal years:					
Roads and trails for States, national forests fund	521,381.05	521,381.05	-----	-----	-----
Cooperative work, Forest Service	599,180.33	599,180.33	-----	-----	-----
Revolving fund for classification of cotton	54,250.66	54,250.66	-----	-----	-----
Fund from seed-grain loans collected during 1922 and 1923	2,081,368.04	-----	2,081,368.04	1,150,281.60	931,086.44
Unexpended balance of allotment for nitrate plants	562,927.29	194,737.10	368,190.19	-----	368,190.19



*Statement of appropriations, expenditures, and balances for fiscal year 1924—*  
Continued

Title of appropriation	Amount available for fiscal year 1924	Expenditures during fiscal year 1924	Unexpended balance, June 30, 1924	Amount turned into surplus fund	Balance available for fiscal year 1925
Unexpended balances of appropriations and funds for prior fiscal years remaining available for expenditure or other disposition during fiscal year 1924—Con.					
Unexpended balances of allotments from other departments for 1922 and 1923:					
Air Service, Army.....	\$202.91	\$199.50	\$3.41	<sup>1</sup> \$3.41	-----
Breeding experimental animals, Army.....	246.43	47.88	198.55	<sup>1</sup> 198.55	-----
Manufacture of arms.....	32.37	-----	32.37	<sup>1</sup> 32.37	-----
Investigations for Federal Power Commission.....	405.62	324.58	81.04	<sup>1</sup> 81.04	-----
Aviation, Navy.....	999.40	999.40	-----	-----	-----
Total, balances of appropriations and funds for prior fiscal years	155,594,649.19	95,115,743.37	60,478,905.82	2,878,191.97	57,600,713.85

## SUMMARY

Current appropriations and funds.....	\$90,157,116.38	\$47,942,204.18	\$42,214,912.20	\$110,002.39	\$42,104,909.81
Balances of appropriations and funds for prior fiscal years.....	155,594,649.19	95,115,743.37	60,478,905.82	2,878,191.97	57,600,713.85
Total.....	245,751,765.57	143,057,947.55	102,693,818.02	2,988,194.36	99,705,623.66

<sup>1</sup> These balances, no longer available for expenditure, totaling \$315.37, were returned to departments from which allotments originated for transfer to surplus fund.

## PUBLICATIONS ISSUED

Series	New		Reprinted		New and reprinted	
	Number of titles	Number of copies	Number of titles	Number of copies	Number of titles	Number of copies
Farmers' Bulletins.....	77	3,973,643	318	6,781,374	395	10,755,017
Department Bulletins.....	74	380,500	45	116,000	119	496,500
Department Circulars.....	42	392,500	15	174,000	57	566,500
Secretary and Miscellaneous Circulars.....	16	1,330,500	5	40,500	21	1,371,000
Statistical Bulletins.....	3	13,500	-----	-----	3	13,500
Yearbook separates.....	14	120,500	7	11,500	21	132,000
Soil Surveys.....	34	34,000	-----	-----	34	34,000
Service and Regulatory Announcements.....	47	296,500	6	12,000	53	308,500
Journal of Agricultural Research reprints.....	92	134,126	-----	-----	92	134,126
Farmers' Bulletin lists.....	-----	-----	3	10,700,000	3	10,700,000
Miscellaneous.....	136	983,265	27	74,110	163	1,057,375
Total.....	535	7,659,034	426	17,909,484	961	25,568,518
Periodical publications:						
Journal of Agricultural Research.....	45	90,000	-----	-----	45	90,000
Experiment Station Record.....	18	122,850	-----	-----	18	122,850
Weather, Crops and Markets.....	26	3,033,000	-----	-----	26	3,033,000
Crops and Markets.....	31	1,287,000	-----	-----	31	1,287,000
Public Roads Magazine.....	4	12,000	-----	-----	4	12,000
Official Record.....	51	816,000	-----	-----	51	816,000
Clip Sheet.....	51	255,000	-----	-----	51	255,000
Weather Review.....	13	20,800	-----	-----	13	20,800
Total.....	239	5,636,650	-----	-----	239	5,636,650
Grand total.....	774	13,295,684	426	17,909,484	1,200	31,205,168







REPORT OF THE CHIEF OF THE DIVISION OF ACCOUNTS  
AND DISBURSEMENTS

UNITED STATES DEPARTMENT OF AGRICULTURE,  
DIVISION OF ACCOUNTS AND DISBURSEMENTS,  
Washington, D. C., October 13, 1924.

SIR: I am transmitting herewith the annual report of the Division of Accounts and Disbursements for the fiscal year ended June 30, 1924.

Very respectfully,

A. ZAPPONE,  
*Chief of Division.*

Hon. HENRY C. WALLACE,  
*Secretary of Agriculture.*

CHARACTER OF THE WORK

As departmental disbursing clerk, the chief of the Division of Accounts and Disbursements, in accordance with law and regulation, pays the accounts submitted to him by the various bureaus, divisions, and services of the department. Accounts are examined to ascertain that approvals are genuine, that computations, extensions, and additions are correct, and that there are appropriations out of which the items are legally payable. A detailed cash-book record of payments is maintained, and controlling appropriation and disbursing ledgers are kept for the 800 or more appropriations, subappropriations, and funds of the department for the current fiscal year and two prior fiscal years, comprising a complete double-entry system of ledgers and journal cash books, with a subsidiary record of settlements made through the General Accounting Office. A separate double-entry ledger and journal cash book record is kept of the transactions under the disbursing clerk's "special account" of trust and special receipt funds.

By the use of a card-index register of the payments made to the individual creditors of the department for the current fiscal year and two prior fiscal years, involving over 200,000 separate accounts and necessitating 500,000 entries annually, duplicate payments are prevented and a ready reference to payees and payments is made available.

The disbursing clerk receives and deposits in the Treasury moneys

accruing to the department from various sources, as well as cooperative trust funds handled through his "special account," and accounts for same to the departmental administrative officers and the General Accounting Office.

Advances of public funds are made to employees of the department for the payment of their expenses while traveling on official business.

The division supervises the placing of funds to the official credit of temporary special disbursing agents and other fiscal officers of the department, receives their quarterly disbursing accounts from the respective bureaus after these have completed their administrative examination, makes a record of the accounts and transmits them to the General Accounting Office. It keeps the departmental record of amounts withheld from employees' salaries under the provisions of the retirement act of May 22, 1920, and during this fiscal year it has prepared the central record for classifying the expenditures of the department under the objects of expenditure prescribed by the Comptroller General in Bulletin No. 1 of May 11, 1922, and maintained a record of liabilities and disbursements in connection with purchases of lands under the Weeks forestry law. Under the direction of the Secretary and the budget officer, it also compiles the annual estimates of appropriations. In addition to the regular financial statements, special and miscellaneous statements and reports are prepared from time to time as required.

## WORK OF THE YEAR

### APPROPRIATIONS, EXPENDITURES, UNEXPENDED BALANCES, ETC.

To carry on the regular work of the Department of Agriculture, consisting of its research, extension, regulatory and service activities, and its campaigns for the control and eradication of animal and plant diseases and pests, during the fiscal year ended June 30, 1924, Congress appropriated or provided \$42,900,301.81. In addition, appropriations and funds amounting to \$47,256,814.57 were provided by Congress to be administered by and expended under the direction of the department for work other than its regular activities, such as Federal highway and forest road and trail construction, cooperative agricultural extension work through the State agricultural colleges under the Smith-Lever Act, research work by the State agricultural experiment stations under the Hatch and Adams Acts, and other special activities devolving upon the department by operation of law, making the total for the fiscal year 1924, for all purposes, \$90,157,116.38. This sum consists of \$69,536,653 carried in the agricultural appropriation act and \$20,620,463.38 in supplemental, permanent annual, special, and indefinite appropriations and funds, and allotments from other departments, as follows: Supplemental appropriations of \$3,688,950 contained in various deficiency appropriation acts; the permanent annual appropriations of \$3,000,000 for the enforcement of the meat inspection act and \$4,580,000 for extension work in agriculture and home economics through the State agricultural colleges; \$1,000,000 for cooperative construction of roads and trails in the national forests; \$3,304,800 for payment of the \$240 bonus or increase of compensation to the employees of the department; \$4,633,646.18 which became available from national forest receipts and Forest Service cooperative funds for cooperative work, road and trail construction, refundments of excess deposits, and payments to the States for the benefit of roads and schools; \$92,898.81 in fees collected for the classification of cotton and sales of cotton standards, used as a revolving fund to pay for the cost of this work; \$222,308.39 collected from farmers to whom seed grain loans had been made in 1921 and 1922, not available for further disbursement but deposited in the Treasury to the credit of the appropriation; \$25,000 for the expenses of the National Forest Reservation Commission, and \$72,860 in allotments transferred from other depart-

ments under the act of May 21, 1920, for work to be done at their request by the Department of Agriculture.

In addition to these appropriations made for the fiscal year 1924, unexpended balances of appropriations for prior years, totaling \$155,594,649.19 remained available for expenditure during this year. By far the largest portion of these balances consisted of \$132,079,279.99 in Federal-aid road construction funds and \$11,279,523.79 in forest road and trail building appropriations, available until expended and almost fully obligated through cooperative road-building agreements with States, counties, and communities. The remainder of the unexpended balances from prior years available for expenditure during the fiscal year 1924, consisted of \$5,385,836.03 under the various appropriations in the agricultural act for the fiscal year 1923, and \$1,043,675.61 under other appropriations for that year; \$3,097,336.79 remaining from appropriations provided by the agricultural act for the fiscal year 1922, and \$1,264,359.29 from other appropriations for that year, and \$1,444,637.69 in unexpended balances of continuing appropriations available until expended.

The total amount available for expenditure during the fiscal year 1924, including these balances from prior years, was, therefore, \$245,751,765.57.

During the year the disbursements by the disbursing clerk, fiscal agents, and temporary special disbursing agents of the department amounted to \$143,057,947.55, of which \$32,937,415.33 was disbursed from the appropriations provided by the agricultural act for the fiscal year 1924, \$15,004,788.85 from the supplemental, permanent annual, special, and indefinite appropriations and funds for that year and allotments from other departments, and \$95,115,743.37 from the unexpended balances remaining available from annual and continuing appropriations for prior years.

At the close of the fiscal year, June 30, 1924, \$102,693,818.02 remained unexpended. Of this sum, \$36,599,237.67 represented unexpended balances of appropriations in the agricultural act for 1924, \$5,615,674.53 unexpended balances of supplemental, permanent annual, special, and indefinite appropriations, and funds and allotments from other departments for 1924, and \$60,478,905.82 unexpended balances of annual and continuing appropriations for 1923 and prior years. On June 30, 1924, \$2,987,878.99 of these balances was transferred to the surplus fund of the Treasury and \$315.37 in allotments



no longer available for expenditure was returned to the departments from which the allotments originated, leaving \$99,-705,623.66 to be carried forward as available for expenditure in the fiscal year 1925. The bulk of this amount consists of \$80,998,354.89 in Federal-aid road building funds, and \$6,555,-971.86 in forest road and trail construction appropriations, almost fully obligated through cooperative road-building agreements.

During the fiscal year 51 trust and special receipt funds were handled through the disbursing clerk's "special account." The balance in this account at the beginning of the year, July 1, 1923, was \$413,519.04; the receipts during the year were \$469,957.61; and the disbursements, transfers to the regular account, and refundments were \$497,439.82; leaving a balance of \$386,036.83 in the account on June 30, 1924. The transactions in this account required the issuance of 13,323

checks on the Treasurer of the United States.

In connection with the regular account of the disbursing clerk, his office examined and paid 214,877 vouchers and pay rolls during the year, requiring the issuance of 370,771 checks on the Treasurer of the United States. The fiscal agents of the Forest Service paid 117,663 additional vouchers and pay rolls and issued 216,226 checks on the Treasurer of the United States.

Of the checks issued by the disbursing clerk, 199 were lost in transit through the mails or by the payees, and were duplicated after bonds of indemnity had been furnished by the payees as required by law and regulation.

The semimonthly payment of salaries of employees stationed in Washington involved the handling and disbursement of \$7,979,138.12 in cash.

During the year 7,870 freight and other accounts were sent to the General Accounting Office for payment.

#### PUBLIC MONEYS RECEIVED BY THE DEPARTMENT

The department received during the fiscal year 1924, from the sources indicated, the following amounts, which were covered into the Treasury:

(a) Deposited to the credit of miscellaneous receipts fund:

1. Forest reserve fund, from sales of timber, grazing fees, and use of forest lands (after deducting from the gross receipts of \$5,366,988.49 refundments of excess deposits amounting to \$115,085.38 and the special fund of \$520,739.92 to be used for forest road and trail building in 1925) .....	\$4, 731, 163. 19
2. Forest Service cooperative fund (the receipts of \$2,618,441.59 are shown below under special funds of the Forest Service) .....	
3. Civil-service retirement deductions .....	884. 35
4. Sales of agricultural products, etc. ....	5, 250. 00
5. Proceeds of sale of Government property .....	88, 025. 89
6. Reimbursement for Government property lost .....	1, 771. 89
7. Damages to Government property .....	270. 76
8. Receipts from United States telegraph and telephone lines .....	7, 661. 27
9. Rent of public buildings, etc. ....	1, 509. 00
10. Interest on seed-grain loans .....	28, 000. 00
11. Reimbursement for inspection of food products .....	160, 679. 36
12. Collections in appeals under grain standards act .....	33, 637. 83
13. Fees under United States warehouse act .....	6, 216. 00
14. Work done by Agricultural Department .....	29, 139. 03
15. Fumigation of cars and wagons .....	66, 878. 50
16. Surplus war materials .....	4, 950. 84
17. Center Market rentals .....	140, 610. 78
18. Center Market storage and other charges .....	118, 978. 45
19. Collections under cotton standards act .....	1, 326. 40

Total deposited to credit of miscellaneous receipts fund (exclusive of Forest Service funds shown immediately below) .....	5, 426, 953. 54
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(b) Deposited to the credit of miscellaneous receipts fund, but subsequently appropriated as special funds for use of the Forest Service:

- |  |                 |
|--|-----------------|
| 1. Ten per cent of net receipts from sales of timber, grazing fees, and use of forest lands, appropriated as special fund for construction of forest roads and trails in 1925----- | \$520, 739. 92  |
| 2. Contributions to Forest Service cooperative fund, appropriated for cooperative work in forest investigations, road and trail building, etc-----                                 | 2, 618, 441. 59 |

Total deposited to credit of miscellaneous receipts fund but subsequently appropriated for use of the Forest Service-----	<u>3, 139, 181. 51</u>
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(c) Deposited to the credit of appropriations for regular work of department:

Bureau of Animal Industry—

- |  |              |
|--|--------------|
| 1. Payments by packers for overtime services of meat-inspection employees-----     | 181, 532. 54 |
| 2. Payments by Navy Department for inspection of meats and meat-food products----- | 50, 765. 65  |

Bureau of Agricultural Economics—

- |   |             |
|---|-------------|
| 3. Reimbursement for cost of classifying cotton---                          | 91, 572. 41 |
| 4. Payments by various departments for the inspection of food products----- | 35, 950. 05 |

Bureau of Soils—

- |  |            |
|--|------------|
| 5. Payments by Interior Department for investigations and classification of soils----- | 9, 163. 79 |
|--|------------|

Various bureaus—

- |   |              |
|---|--------------|
| 6. Miscellaneous collections, including refunds on unused railroad tickets and scrip, recoveries and refundments on account of overpayments, etc----- | 125, 252. 83 |
| 7. Disallowances by General Accounting Office in disbursing clerk's account-----  | 733. 97      |

Total deposited to credit of appropriations for regular work of the department-----	<u>494, 971. 24</u>
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(d) Deposited to the credit of other appropriations administered by the department:

Bureau of Public Roads—

- |   |              |
|---|--------------|
| 1. Reimbursement for cost to department of distributing surplus war materials to various States for use in road construction----- | 781, 745. 60 |
|---|--------------|

Seed Grain Loan Committee—

- |  |              |
|--|--------------|
| 2. Repayment by farmers of seed grain loans made to them during fiscal years 1921 and 1922---- | 222, 308. 39 |
|--|--------------|

Total deposited to the credit of other appropriations administered by the department.	<u>1, 004, 053. 99</u>
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Total receipts during fiscal year 1924-----	<u>10, 065, 160. 28</u>
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*Statement of appropriations, disbursements, and unexpended balances for the  
United States Department of Agriculture*

[Fiscal years 1839 to 1920, inclusive]

Fiscal year	Amount appropriated	Amount disbursed	Amount unexpended	Fiscal year	Amount appropriated	Amount disbursed	Amount unexpended
1839..	\$1,000.00	\$1,000.00	-----	1880..	\$210,500.00	\$209,361.72	\$1,138.28
1840..	-----	-----	-----	1881..	284,300.00	276,448.53	7,851.47
1841..	-----	-----	-----	1882..	371,500.00	362,961.34	8,538.66
1842..	1,000.00	1,000.00	-----	1883..	686,941.00	669,486.61	17,454.39
1843..	-----	-----	-----	1884..	648,140.00	645,116.96	3,023.04
1844..	2,000.00	2,000.00	-----	1885..	877,690.00	780,694.64	96,995.36
1845..	2,000.00	2,000.00	-----	1886..	825,248.00	666,470.89	158,777.11
1846..	3,000.00	3,000.00	-----	1887..	872,715.00	843,360.33	29,354.67
1847..	3,000.00	3,000.00	-----	1888..	1,864,730.00	1,848,793.56	15,936.44
1848..	4,500.00	4,500.00	-----	1889..	1,975,080.00	1,874,189.62	100,890.38
1849..	3,500.00	3,500.00	-----	1890..	1,804,200.00	1,605,884.51	198,315.49
1850..	5,500.00	5,500.00	-----	1891..	2,336,502.00	2,230,730.15	105,771.85
1851..	5,500.00	5,500.00	-----	1892..	3,538,153.00	3,487,759.54	50,393.46
1852..	5,000.00	5,000.00	-----	1893..	3,323,060.00	3,138,429.53	184,630.47
1853..	5,000.00	5,000.00	-----	1894..	3,708,500.00	3,082,113.70	626,386.30
1854..	10,000.00	10,000.00	-----	1895..	3,611,915.00	3,126,030.38	485,884.62
1855..	50,000.00	50,000.00	-----	1896..	3,688,750.00	3,199,653.20	489,096.80
1856..	30,000.00	30,000.00	-----	1897..	3,940,532.00	3,840,281.45	100,250.55
1857..	75,000.00	75,000.00	-----	1898..	3,572,902.00	3,530,510.44	42,391.56
1858..	63,500.00	63,157.25	\$342.75	1899..	3,987,202.00	3,958,212.73	28,989.27
1859..	60,000.00	60,000.00	-----	1900..	4,127,922.00	4,069,503.42	58,418.58
1860..	40,000.00	40,000.00	-----	1901..	4,423,500.00	4,358,371.42	65,128.58
1861..	60,000.00	60,000.00	-----	1902..	5,090,433.00	5,070,328.28	20,104.72
1862..	64,000.00	63,704.21	295.79	1903..	6,206,960.00	5,925,344.84	281,615.16
1863..	80,000.00	80,000.00	-----	1904..	6,740,024.00	6,684,311.63	55,712.37
1864..	119,770.00	109,270.00	10,500.00	1905..	6,589,540.00	6,513,865.63	75,674.37
1865..	150,604.00	150,496.50	107.50	1906..	8,370,690.00	8,174,510.02	196,179.98
1866..	167,787.82	167,787.82	-----	1907..	11,116,440.00	9,916,252.70	1,200,187.30
1867..	199,100.00	199,100.00	-----	1908..	13,613,040.00	13,170,739.63	442,300.37
1868..	279,020.00	277,094.34	1,925.66	1909..	16,063,106.00	15,756,766.45	306,339.55
1869..	210,198.00	210,198.00	-----	1910..	17,136,736.00	16,725,796.13	410,939.87
1870..	156,440.00	151,596.93	4,843.07	1911..	20,832,636.00	20,368,954.64	463,681.36
1871..	188,180.00	186,876.81	1,303.19	1912..	22,403,209.00	20,986,207.28	1,417,001.72
1872..	197,070.00	195,977.25	1,092.75	1913..	22,662,315.00	21,971,927.22	690,387.78
1873..	202,440.00	201,321.22	1,118.78	1914..	24,086,945.00	23,348,321.00	738,624.00
1874..	259,871.00	235,946.78	23,924.22	1915..	28,880,075.00	28,113,863.88	766,211.12
1875..	357,380.00	341,079.83	16,300.17	1916..	28,004,082.00	27,594,068.32	410,013.68
1876..	264,120.00	213,843.64	50,276.36	1917..	36,133,100.00	34,360,180.56	1,772,919.44
1877..	333,687.00	327,206.23	6,480.77	1918..	71,130,513.00	65,969,604.07	5,160,908.93
1878..	327,640.00	326,634.94	1,005.06	1919..	114,087,216.00	108,937,668.18	5,149,547.82
1879..	217,400.00	217,360.00	40.00	1920..	142,733,924.00	70,265,464.64	172,468,459.36

<sup>1</sup> Does not include unexpended balances of annual and continuing appropriations from prior fiscal years of \$124,248,854; total balance available for further disbursement in fiscal year 1921, \$196,717,313.









## REPORT OF CHIEF OF BUREAU OF AGRICULTURAL ECONOMICS

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF AGRICULTURAL ECONOMICS,  
*Washington, D. C., September 25, 1924.*

SIR: I have the honor to transmit herewith a report of the work of the Bureau of Agricultural Economics for the fiscal year ended June 30, 1924.

Respectfully,

HENRY C. TAYLOR,  
*Chief of Bureau.*

HON. HENRY C. WALLACE,  
*Secretary of Agriculture.*

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The second year of operation of the Bureau of Agricultural Economics was completed June 30, 1924. This bureau, which was formed by the consolidation of the Bureau of Markets and Crop Estimates and the Office of Farm Management and Farm Economics, is proving to be a most effective organization in dealing with the economic problems of agriculture. While the work has been broadened in many lines, the principal improvement has been in the adoption of more intensified methods of study and the redirection of the forces of the bureau toward the economic problems of greatest current importance. The coordination of workers in the closely related fields of crop estimating, marketing, and farm management has made it possible for the bureau to render a service of greater practical value to farmers and at the same time to secure greater economy in administration.

### ECONOMIC INFORMATION DEMANDED

The demands upon the bureau for assistance and information have been particularly heavy during the past year due largely to the unsatisfactory and rapidly changing agricultural conditions. The bureau has met this demand as fully as possible by bringing its forces to the study of specific problems and at the same time continuing the general services and re-

search on fundamental problems. It has been our purpose to apply available knowledge to readjustment problems, to aid farmers in meeting the changed conditions, and to anticipate further changes where possible. The rapidly changing agricultural situation has made it necessary that the significant factors influencing supply, demand, and prices of farm products be measured constantly. It has been our purpose to bring together these facts to serve as a sort of barometer of the agricultural industry. Several forms of new work designed to aid in accomplishing this purpose were inaugurated.

### OUTLOOK REPORT EXTENDED

The agricultural outlook reports inaugurated last year have been well received by agricultural workers and farmers and utilized as a basis for planning farm operations. The preparation of these reports which look into the future is now a thoroughly established part of the work of this bureau. These reports represent the best thought of our technical workers, tempered by close contact with the practical problems of production and marketing. The surveys of the intentions of farmers regarding planting plans and livestock-breeding operations have been more widely appre-



ciated and indorsed as their purpose has become better understood.

Close study has been given to world-wide agricultural conditions in connection with domestic problems in anticipating probable trends of production and market prices; research work has been arranged to supply the basic facts and develop methods of forecasting trends wherever possible; well-trained men have been added to the staff of the bureau for such work, and the personnel has been strengthened by redistribution of duties to make the best possible use of the training and skill of each worker.

The relation of agriculture to other industries has been given particular attention. Close study of the income of agriculture as an industry and of individual farmers has been made for the purpose of determining what may be expected as a reasonable return and to discover what conditions may be adjusted. The studies of cost of production, cost of marketing, the returns of agriculture, and farm income have all contributed to an understanding of this subject.

From studies made in this bureau it has been found that the rate of return on the farmers' capital investment has increased from the figure —3.1 per cent for the crop year 1920-21 to 1.4 per cent for the crop year 1923-24. It must be noted also that during these four years farmers experienced a deflation of property value by which the worth of capital investments owned by farm operators dropped from \$48,500,000,000 to \$33,422,000,000. While some improvement is noted, it is obvious that the income from agricultural production since the depression, which commenced with the price decline in 1920, has not been sufficient to allow both a commercial interest return on the capital used in the farming industry and an adequate wage for the labor of the farmer and his family.

This bureau is therefore giving intensive study to the problems involved in securing for agriculture its proportionate reward. The bureau endeavors to show the relation of more efficient farming and marketing to the problem of securing a fair share of the national income, as a basis of an adequate standard of living on farms and in rural communities. The publication of the facts as disclosed by careful statistical studies covering many localities, and at the same time making recommendations for changes wherever it appears that a

change will be beneficial, is helping farmers to eliminate present losses and to inaugurate programs of production which will yield them a better return for their labor and capital.

### FARM MANAGEMENT AND COST

At the close of the fiscal year the farm management and cost of production work of the bureau were consolidated. This step brings into still closer coordination the work which aims to assist farmers in modifying their programs of production in order to secure a greater return. Recommendations will be made for crop and livestock adjustment, based upon the close study of farm organization and cost, which will help to reduce the losses that result from misdirected effort.

Profitable systems of various types of farming, the lessons which come from the close study of costs, and the changes necessitated by shifting market demand will be considered more closely in order to secure practical results. An effort will be made to anticipate changes in types of farming in order to warn farmers against practices which may lead to loss.

### FOREIGN COMPETITION AND DEMAND

Much progress has been made in the establishment of a world crop and market reporting service, and valuable information with regard to world conditions is being made public. Many problems arise, however, in connection with the marketing of American agricultural products abroad which need the attention of men specially trained in agriculture and who have intimate knowledge of American production and of the interpretation of American standards for farm products. To meet this need the bureau has sent to the foreign field a number of highly trained men who will maintain contacts with agencies purchasing American products, and will handle problems arising in connection with the marketing of American farm products. These men will also furnish first-hand information with regard to trends of production in foreign countries and interpretations and analyses of all the factors affecting the demand for American farm products.

Both domestic and foreign markets are being studied to discover probable future requirements as well as immediate needs. Surveys of the market-

ing of leading commodities are being prepared in a series of commodity bulletins which present the economics of production as well as a description of the present channels and methods of distribution. Reviews of price changes and the market for products of various kinds and qualities accompany these surveys.

### CROP ESTIMATING

Marked advances in the development of crop and livestock forecasting and estimating have been made during the year. Not only has the scope of the work been widened, but the statistical methods used have been improved. New and better methods of estimating acreage have been devised, the price reporting work has been enlarged and strengthened, the semiannual pig surveys made through rural mail carriers have been expanded to include dairy cows and poultry, the "intention to plant" surveys have been further developed and have become a regular part of the work of the bureau, and the statistical technique of the forecasting and estimating work has been improved. The inauguration of extension work in statistics has been an important new factor that will greatly widen the field of usefulness of agricultural statistics. The forecasts and "intentions to plant" surveys furnish a timely basis for the readjustment of the farm program.

### MARKET NEWS SERVICE

There has been a steady and consistent demand throughout the country for more complete and timely information, and during the present year it has been possible to meet this demand in a measure by a substantial expansion of the market news service of the bureau. Congress increased the appropriation for the market news service for 1924 by \$300,000 over the appropriation for the preceding year, notwithstanding the fact that a vigorous policy of retrenchment in national expenditures has been adopted. This increase made it possible to extend the leased-wire system of the bureau to Florida and to the Pacific coast, thus reaching areas of heavy production of perishable products. Steady improvement has been made in the methods of furnishing the type of information needed in the various sections and very wide dissemination of information is being effected through the use of the radio broadcasting stations. As a result, the grower has secured a better distribution, espe-

cially of his perishable products, than ever before, and the fluctuation of prices generally has been relatively the same in both large and small markets throughout the greater portion of the country.

### STANDARDIZATION AND INSPECTION

Greater progress was made during the past year than ever before in the formulation of standard grades for fruits and vegetables. In fact, the number of fruits and vegetables for which grades were formulated was doubled during the past year. This work was stimulated by the fact that uniform grades are essential to the success of the shipping-point inspection service, which has expanded greatly in an effort to meet the requests of producers and shippers for this service. The demand has from the beginning been greater than the bureau could meet with the funds available for the purpose, although substantial increases in appropriations have been granted by Congress from year to year. It should be noted that inspections are made upon request only, and that fees are collected for the service rendered, which are turned into the Treasury of the United States, thus making the service largely self-supporting.

Seventy-three thousand cars of fruits and vegetables were inspected during the fiscal year 1923, 129,000 during 1924, and there is prospect of a further increase during the current year. Developments of economic significance under the inspection service are, first, that it is now possible for a producer to sell f. o. b. shipping point to a distant buyer on the basis of the Government certificate of inspection, and, second, that a practical program of grading at producing points has been enforced, which has resulted in preventing the shipment of large quantities of deteriorated and unsalable products, which bring nothing but losses to producers because of the fact that the handling and shipping charges must be met even though the product can not be sold on arrival at market. Proper grading on the farm also insures the consumer of getting better products for the same cost.

The timothy and clover grades were revised during the year and very satisfactory progress was made in the inspection service on hay. Work is well under way leading to the promulgation of standards for alfalfa, wild hay, and Johnson grass, and an inspection service on these classes of hay will be begun during the coming year.



An inspection service has been inaugurated on eggs at Chicago and New York which is proving very popular. The grades developed by the bureau are used as the basis of this service. The butter-inspection service has been expanded largely through cooperative arrangements with associations which are desirous of establishing the Federal-inspection service. Standardization work has been conducted also in connection with many other products. This work will be covered in detail under the commodity divisions.

### CONSUMER DEMAND STUDIES

The market news and other services of the bureau furnish information with regard to the supply, movement, prices, etc., of farm products. It is necessary also that information be secured with regard to the demand for such products. This bureau has recently taken up the study of consumer demand and is gradually working out methods by which this demand may be forecast. Studies of this nature have been carried on in Boston, Philadelphia, Chicago, Pittsburgh, and other cities and in the vicinity of a large number of growing cities throughout the country. It has been found that cities often draw their supply of food products from distant points when such products could be produced more profitably in the immediate vicinity. In each case, after the locality has been surveyed, recommendations are prepared and made public, and it has been found that in all cases these recommendations have been adopted very largely in planning the future production programs.

### WORK OF BUREAU ENLARGED

During the last two sessions of Congress a number of acts have been passed which enlarge and strengthen the work of the bureau. The first of these were the amendments to the United States warehouse act of March 23, 1923. The warehouse act formerly applied to only four commodities, i. e., cotton, grain, wool, and tobacco. Through these amendments the limitation was removed, and now warehouses may be licensed for the storage of any agricultural products which the Secretary of Agriculture may deem properly storable. During the past year investigations preliminary to drafting regulations for the storage of peanuts, potatoes, broomcorn, beans, nuts, hay, dried and canned fruits, apples, and cane sirup were made. Regulations for the storage of peanuts were pro-

mulgated on September 29, 1923; for the late crop of potatoes on May 10, 1924; for broomcorn on May 16, 1924. Regulations for the storage of dry edible beans have been drafted and will be submitted for promulgation in time to take care of the coming season's crop.

On March 4, 1923, the United States cotton standards act was approved. This act makes the use of the official cotton standards of the United States mandatory in interstate and foreign commerce. As a result of the passage of this act universal standards for American upland cotton have been promulgated and are now being used as the basis for trading throughout the world. This act provides also for the classing of spot cotton by licensed agents of the department for anyone who seeks the service.

On May 3, 1924, an act authorizing the Department of Agriculture to issue semimonthly cotton crop reports and providing for their publication simultaneously with the ginning reports of the Department of Commerce was passed. Much preliminary work was done before the close of the fiscal year in order to put this legislation in effect on August 1, 1924, as provided by law. With the inauguration of this service the cotton industry will be provided with more complete information than ever before.

### ORGANIZATION OF THE BUREAU OF AGRICULTURAL ECONOMICS

The principal divisions of the bureau as organized at the close of the fiscal year are as follows:

#### ADMINISTRATION

HENRY C. TAYLOR, *Chief*.  
 LLOYD S. TENNY, *Assistant Chief*.  
 WILLIAM A. SCHOENFELD, *Assistant Chief*.  
 J. CLYDE MARQUIS, *Director of Economic Information*.  
 C. W. KITCHEN, *Business Manager*.  
 F. J. HUGHES, *Personnel*.  
 H. F. FITTS, *Administrative Assistant*.

#### PRODUCTION DIVISIONS

*Farm Management and Costs*.—M. L. WILSON.

Farm organization.  
 Livestock costs.  
 Crop costs.  
 Types of farming.  
 Farm records and accounts.  
 Crop and livestock adjustments.

*Crop and Livestock Estimates*.—W. F. CALLANDER.

Crop Reporting Board.  
 Research in statistical methods.  
 Livestock reporting.  
 Tabulating and computing.  
 Crop reporting.  
 Price reporting.



## MARKETING DIVISIONS

- Cotton*.—A. W. PALMER.  
 Supervision of cotton futures and cotton standards acts.  
 Cotton standardization and classification.  
 Cotton market news.  
 Research in cotton marketing and handling methods and costs.  
 Research in cotton standardization and spinning qualities.  
 Standardization of cottonseed and products.  
 Foreign competition and demand.
- Fruits and Vegetables*.—W. A. SHERMAN.  
 Market news service.  
 Inspection service.  
 Grades and standards.  
 Standard containers.  
 Research in marketing methods and costs.  
 Foreign competition and demand.
- Livestock, Meats, and Wool*.—C. V. WHALIN.  
 Market news service.  
 Livestock marketing investigations and market movements.  
 Livestock grade standardization.  
 Purebred livestock marketing investigations and prices.  
 Meat marketing investigations.  
 Meat grade standardization.  
 Meat grading service.  
 Market research analysis and cost studies.  
 Wool marketing and standardization.  
 Foreign competition and demand.
- Cost of Marketing*.—A. V. SWARTHOOT.
- Operation of Center Market*.—C. W. KITCHEN.
- Grain*.—H. J. BESLEY.  
 Grain investigations.  
 Milling and baking investigations.  
 Research laboratory.  
 Establishment of grades for barley.  
 Rice standardization and investigations.  
 Grain cleaning.  
 Bulk handling.  
 Methods and costs of marketing grain.  
 Federal grain supervision.  
 Foreign competition and demand.
- Dairy and Poultry Products*.—ROY C. POTTS.  
 Market news service.  
 Dairy inspection service.  
 Dairy products investigations.  
 Poultry products investigations.  
 Research in marketing methods and costs.
- Hay, Feed, and Seed*.—W. A. WHEELER.  
 Market news service.  
 Hay marketing investigations.  
 Feed marketing investigations.  
 Seed marketing investigations.  
 Hay standardization.  
 Hay inspection service.  
 Broomcorn market investigations.  
 Standardization of beans and peas.
- Warehousing*.—H. S. YOHE.  
 Grain warehousing.  
 Wool warehousing.  
 Tobacco warehousing and standardization.  
 Cotton warehousing.  
 Fruits, vegetables, and nuts warehousing.  
 Broomcorn warehousing.

## GENERAL DIVISIONS

- Agricultural Finance*.—NILS A. OLSEN.  
 Farm credit.  
 Farm taxation.  
 Farm insurance.
- Statistical and Historical Research*.—O. C. STINE.  
 Foreign competition and demand.  
 Market statistics.  
 Production statistics.  
 Transportation.  
 Statistical analyses.

*Statistical and Historical Research*—Con.

- Agricultural history.  
 Graphics.
- Agricultural Cooperation*.—CHRIS L. CHRISTENSEN.  
 Economics of cooperation.  
 Statistics of cooperation.  
 Legal phases of cooperation.  
 Accounts and business practices of co-operative associations.
- Farm Population and Rural Life*.—C. J. GALPIN.  
 Farm population statistics.  
 Population aspects of rural community buildings.  
 Farmers' standard of living.  
 The farm village.
- Economic Library*.—MARY G. LACY.
- Land Economics*.—L. C. GRAY.  
 Land resources and utilization.  
 Land reclamation, sale, and settlement.  
 Farm labor.  
 Land tenure.  
 Land values.
- Division of Information*.—J. C. MARQUIS.  
 Editorial.  
 Periodicals and press service.  
 Radio news service.  
 Exhibits and motion pictures.  
 Consumer demand research.

## DIVISION OF FARM MANAGEMENT

H. R. TOLLEY, *In Charge*

Farm Practices and Types of Farming, W. J. SPILLMAN; Organization of Southern Farms, C. L. GOODRICH; Organization of Irrigated Farms, BYRON HUNTER; Farm Records and Accounts, J. W. TAPP; Farm Business Analysis, H. W. HAWTHORNE; Farm Incomes, S. W. MENDUM; Farm Power, L. A. REYNOLDS.

The Division of Farm Management seeks to bring about the practical application of the principles of farm management and to bring to farmers just the type of information which they need to enable them to meet their specific local problems. Effort is made to assist farmers in adjusting their programs to meet the changing agricultural conditions. This assistance is given first by putting within the farmers' reach all possible information with regard to world production of agricultural products and the prospective demands for such products; and, second, by furnishing authentic information on methods of organizing and managing farms which are proving most successful. In order to be of most benefit, representatives of this division study local problems with a view to making recommendations which will meet the peculiar local conditions. In all this work close cooperation is maintained with other divisions which handle land utilization problems, studies of costs of production, crop and livestock estimates and marketing problems, and with State experiment stations and extension divisions.

### AGRICULTURAL READJUSTMENTS IN AREAS SURROUNDING GROWING CITIES

Very helpful work has been done in assisting farmers in areas surrounding many growing cities to readjust their production programs. Changes in transportation costs have made many adjustments desirable; as where food products were formerly produced under more favorable soil and climatic conditions and shipped long distances, present freight rates make it more desirable to produce these products closer at hand. Owing to lack of information with regard to local demands, foods are often shipped great distances when they might be produced with profit in the immediate neighborhood.

Studies of areas around cities designed to determine to what extent farmers are meeting the needs of their local markets were made at Altoona, Pa., Fayetteville, N. C., Charleston, W. Va., and Richmond, Ind. The findings of these studies are being used as the basis of the agricultural program for the different areas. These studies determine the amounts of different foodstuffs consumed in the area, the places where these foodstuffs are produced, the agricultural production in the area, the part of the agricultural production consumed in the area, the part shipped to distant markets, the possibility of increased profits to the farmers of the area through increased production for the local market, and other changes in production and marketing practices that would result in greater profits to farmers or lower costs of food to the consumers. During the latter part of the year similar studies were begun at Macon, Ga., Lebanon, Pa., Roanoke, Va., and Atlantic City, N. J. Other divisions of the bureau and the State colleges and experiment stations have assisted in all these studies.

### AGRICULTURAL READJUSTMENTS IN THE SPRING-WHEAT REGION

This study, begun the previous year by this division and the Division of Land Economics in cooperation with the State colleges and experiment stations in North Dakota, South Dakota, and Montana, was practically completed during the year. Between 600 and 700 farmers in the area were visited, reports of their financial progress since settling were obtained, and from their experience an effort has been made to determine the systems of farming best adapted to the region.

When completed this material will be placed in the hands of extension forces in the region and assistance given in placing the findings before the farmers. Much educational work has already been done in assisting farmers to diversify their program of production and it is expected that the facts secured by this study will go far toward answering the needs of farmers for authentic information with regard to possibilities of future development of a profitable agriculture in this region.

### COST OF PRODUCING MILK

From a farm-management survey made in Chester County, Pa., records were obtained from 424 farms. In addition to data on the entire farm business, complete figures were obtained on the operation of the dairy enterprise. Dairying is the keystone of the farming system of Chester County, but there are wide differences in the efficiency with which milk is produced. The first analysis of the data was therefore directed to an "input-output" study of the dairy enterprise. A preliminary report entitled "Farm Practices which Determine Profit or Loss in Milk Production in Southeastern Pennsylvania" was published, giving the results of this study. This report showed the specific practices that determine the efficiency of milk production, and made concrete suggestions as to methods of making improvements; that is, as well as showing that there were wide differences in cost of production, it showed specific ways in which farmers in the area may reduce that cost. Copies of this preliminary report were sent to all farmers from whom records had been obtained. Meetings were held in Chester County in cooperation with the county agent during the winter to discuss this report with the farmers. These meetings were attended by more than 250 men, and much interest in the results was displayed. A summary of the dairy enterprise results on their own farms was sent to each of the farmers surveyed who attended these meetings. In addition, upon request the county agent was sent copies of the dairy-enterprise record for all men whose herds were doing poorly, so that he might visit them and help better their dairy practices. A further study of the organization of the farms surveyed to determine the other factors necessary to profitable farming in the region is now under way.



## FARM RECORDS AND ACCOUNT WORK

The analysis and publication of material collected on the farm records and accounts routes conducted jointly by the bureau and various State colleges and experiment stations was continued. During the year a representative of the division assisted in preparing reports covering studies of farm organization in southwestern Minnesota, in central Kansas, and in the Gallatin Valley, Mont. A manuscript entitled "More Profits for the Wheat Farmers of Central Kansas" was also prepared for publication.

The object of this work is to assist cooperating farmers to reorganize their farms for greater profit and to obtain material which will be useful to other farmers similarly situated in determining what readjustments they might make profitably. That this work is producing results is evidenced by numerous reports received from producing sections and from the ever-increasing requests for this type of assistance. Increasing effort is being made to bring the results of the research work directly to the farmers concerned. In this the bureau is assisted by the Extension Service of the department, by State organizations, and others.

## RESEARCH METHODS IMPROVED

A new method of analysis for determining the definite relations between goods or services used up in production and the resulting output, together with means for determining what combinations of practices are most profitable under specific price conditions, was perfected during the year and published in a bulletin entitled "The Relation of Input and Output in Farm Organization and Cost of Production Studies," so that it will be available to other research workers. The statistical method employed was tested and found satisfactory, and a technical article describing it prepared for the Journal of the American Statistical Association. A special study to find the best method of determining the value of different classes of labor on the farm was practically completed.

## TYPES OF FARMING

A study of the geographical distribution of types of farming was continued, and data obtained from censuses of 1909 and 1919 for relative crop areas and number of animals per

100 acres of crops were compiled and charted by counties for all States. These data are of value in outlining agricultural programs and are in demand from National and State extension services.

## IRRIGATED FARMING IN IDAHO

A study of irrigated farming in southern Idaho begun in former years was practically completed. The final report on this study deals with the principal changes which have taken place in crop and livestock production during the development of the area studied, the causes of these changes, the present types of farming and methods of production, and the factors which contribute to success or failure in the organization and management of the farms. Much interest has been shown in late years in irrigated agriculture, and the final report of this study will be of much interest and helpful to the farmers of the Twin Falls south side project, where the study was made; to other farmers on irrigation projects where conditions are similar to those of Twin Falls, and to settlers who during the coming years will undertake to develop farms from the raw sagebrush on irrigation projects yet to be undertaken.

## IRRIGATION IN THE YAKIMA VALLEY

The two-year study of farm organization and production problems on irrigated farms in the Yakima Valley, Wash., was completed this year. The study was cooperative between the state college of Washington and the Bureaus of Plant Industry and Agricultural Economics. A bulletin covering the results of the survey is now nearly completed, which shows how a farmer in this area can best work out the most successful farm organization for his particular conditions.

## PRISON FARM SYSTEM IN TEXAS

The Agricultural and Mechanical College of Texas asked the division to assist it in studying the organization and operation of the 14 prison farms of that State, on which approximately 4,000 prisoners are employed, with a view to determining how the farms might be made to yield greater profits, and how the conditions of the prisoners working on these farms could be improved. A representative of the division spent three months on the farms and left with the col-



lege authorities a large number of recommendations, which when put into effect will do much toward placing the prison system of the State on a self-supporting basis.

#### STUDIES IN SOUTHERN STATES

Farm management studies undertaken in former years for the purpose of obtaining information on which to base sound recommendations for changes in farm organization and operation were continued in cooperation with the States of South Carolina, Georgia, Mississippi, Arkansas, Louisiana, and Virginia.

#### REPORTS ON SUCCESSFUL METHODS

Records of farming operations and results obtained in former years were analyzed. The following reports are being published: "Successful farming on 80-acre farms in central Indiana," "Successful farming on 160-acre farms in central Indiana," and "Value to farm families of food, fuel, and use of house." The latter contains data from 30 localities in 21 States from 1918 to 1922, and is based on records from 7,738 farms.

"Analyze your business," a lecture illustrated with lantern slides, has been prepared for use through the Extension Service of the department. Assistance was given also to the Extension Service of the department in writing a scenario and filming a motion picture entitled "Citrus Fruits in Florida." The object of the picture is to show successful methods and practices in managing citrus groves and in handling and marketing fruit.

#### RETURNS FROM FARMING MEAGER

In order that authentic information might be obtained the collection and compilation of incomes from farming begun in former years was continued and expanded. Reports of receipts and expenses for the calendar year 1923 from over 16,000 farmers were obtained and tabulated. These reports showed an average return of \$1,020 for the use of \$17,500 of capital and the labor of the farmer and his family. The average cash receipts were \$2,240, inventories increased \$130 during the year, and the average cash outlay was \$1,350. In addition the average farmer produced food and fuel consumed on the farm estimated to be worth \$250 and had the use of the farmhouse, the rent of which was

not reported. Interest paid on debts during the year averaged \$230, and the reported outlay for improvements averaged \$140. Although returns were low there was some improvement over the previous years. Figures from 6,000 similar farms for 1922 showed average cash receipts of \$1,972, increases in inventories of \$202, an average cash outlay \$1,257, and food and fuel produced and used on the farm to the value of \$294.

This question of the farmers' returns has also been attacked from a different angle in the Division of Statistical and Historical Research. In this study the total value of all agricultural production, the total value of all capital invested in agriculture, the total farm indebtedness (mortgage and other), changes in inventory values, and all operating expenses were considered. The values derived for the total net income from agriculture available for farmers' net investment and for the management and labor of farmers and their families during the past 5 years ended June 30 were as follows:

1920-----	\$8, 143, 000, 000
1921-----	4, 773, 000, 000
1922-----	3, 588, 000, 000
1923-----	4, 459, 000, 000
1924-----	4, 887, 000, 000

The percentages derived, after interest on debt and an average hired-labor wage for operators were subtracted, show that for the crop year 1919-20 the return on the farmer's capital investment was 5.8 per cent. For the crop year 1920-21 this return dropped abruptly to the figure -3.1 per cent. Since that time the rate of return has somewhat improved and for 1923-24 stood at 1.4 per cent. It should be noted also that farmers experienced a deflation of property value by which the worth of capital investments owned by farm operators dropped from \$48,500,000 to \$33,422,000,000 in these four years.

This study also determined the rewards for the farmer's labor and management after allowing a commercial interest return on the operator's capital investment. It was shown that the average farmer and his family earned \$932 in 1919-20, \$399 in 1920-21, \$292 in 1921-22, \$454 in 1922-23, and \$520 in 1923-24. Except for 1919-20 the farmers received rewards for their own and family labor and their managerial services which were lower than the annual wages of hired labor.

## DIVISION OF COST OF PRODUCTION

R. H. WILCOX, *In Charge*

Farm Records and Accounts, O. A. JUVE;  
Crop Costs, M. R. COOPER; Livestock  
Costs, G. S. KLEMMEDSON and R. D. JEN-  
NINGS; Cost and Price Relations, C. R.  
HAWLEY.

The Division of Cost of Production has centered its work upon answering those problems in farm practices, methods and organization with which the farmers of the United States are confronted. Studies of the cost of producing farm products and the relation of costs to prices are carried on in order to help the farmer in determining the most productive and profitable types of livestock and crops to produce and the most efficient methods to employ in the management and production of crops and livestock. A number of bulletins have been prepared for publication during the past year, as well as preliminary reports, mimeographed releases, and other types of information containing data of value to farmers, extension workers, and others.

### FARM ACCOUNTING WORK

Farm records and accounts work is carried on cooperatively by this division with 13 State colleges and experiment stations. The purpose of this work is to make available to farmers the essential factors of good farm organization and to show how to organize farms for the maximum income. This work was expanded during the past year by beginning three new field studies in cotton and tobacco areas, where but little information has heretofore been available. It is expected that these new studies will help to facilitate the adjustment which farmers in these areas are making, as a result of boll-weevil damage to cotton and changing price relations. Each farmer contributing to these studies is supplied with forms upon which complete records are kept, showing for each crop the amount of labor, machinery, cash expenses, and other elements of cost. The keeping of such records enables the farmer to put his operations upon a business basis, besides furnishing the department with valuable records.

### PRACTICAL USE OF MATERIAL

Renewed efforts were made during the year to develop methods of analysis and presentation that would make the material collected of greatest usefulness to farmers. New projects are

being initiated with the idea of making the material collected more quickly available for the use of farmers and extension agencies. The material presented enables farmers to check up their methods and costs and compare their own operations with the standard of their own community and with that of other sections.

### ASSISTANCE GIVEN CATTLEMEN

In the study of livestock farming the work in ranch economics was expanded to include studies in Colorado and Texas. It has been the purpose of this study to analyze ranch organization, including the distribution of investment, kinds and quality of land and forage, and the distribution of land area, to study the factors of production available upon each ranch with a view to determining the most profitable uses to which these factors of production may be placed. From the study of ranch organization and cost of production on 56 ranches many valuable suggestions have been made through published reports and personal visits. Closely related to the work in ranch organization has been the study of the handling of cattle during the summer on the short grasses of the Flint Hills of Kansas. This year saw the termination of a three-year study in Chase County, Kans., upon 35,000 head of cattle. The object of this study was to obtain the fundamental basic requirements of pasture area, feed, labor, and miscellaneous-cost items in beef production and to study the economic position of summer grazing of cattle in Kansas in its relation to the beef-cattle industry and to the markets for livestock. In addition to the work upon ranches, an investigation was made into the costs of carrying cattle on the national forest ranges of the West. In continuing the work on the cost of fattening cattle in the Corn Belt, the data covering five years' work have been analyzed and prepared for publication.

### PRODUCTION OF HOGS AND DAIRY PRODUCTS

The study of the cost of producing hogs has been expanded during the past fiscal year to cover approximately 150 farms. On these farms there is being secured facts regarding the management of swine herds and the feed and labor requirements on hogs that are handled under the different methods of pork production practiced in the Corn Belt. Cooperative



studies have been continued with New York on the cost of producing dairy products. It has been the purpose of this dairy-cost work to study the requirements of production for milk of different grades and from cows varying in production capacity and to place in the hands of producers information upon the organization of farms for maximum income.

#### PRODUCTION OF CORN, WHEAT, COTTON, AND POTATOES

The costs of producing corn, wheat, and oats during 1922 were secured throughout the United States and results of this study published in September, 1923. Costs of producing corn, wheat, cotton, and potatoes were secured by questionnaires. The number of schedules used in these tabulations were as follows: Corn, 11,238; wheat, 7,852; oats, 8,481; potatoes, 2,694; and cotton, 2,519. During June further detailed tabulations were made, and a more detailed report of 1923 costs is being prepared. About 10,000 questionnaires were sent out on labor requirements in the production of cotton, and the tabulation of this material is well under way. Over 780 cotton-cost records have been obtained in 15 counties of the eight Cotton States. Additional information on cost trends of taxes, labor, fertilizer, machinery, and ginning from 1913 to 1923 were obtained in this survey. It is the object of this study not only to show the cost of producing cotton in 1923 but by the use of cost figures for the past 10 years to show the trends of costs and their relationship to the things the southern farmer has to purchase. In a cotton study in Anderson County, S. C., 333 farm-survey records were obtained and reports prepared. The facts established by these cost studies are given wide publicity, and care is taken to carry the information back to the particular regions studied so that farmers whose operations are studied may have a guide for future operations.

#### FRUIT PRODUCTION

Studies have been made of the apple production in the Shenandoah Valley and of the costs of producing peaches in New Jersey. Final tabulations for the six-year citrus fruit study in Florida have been completed. During July and August, 1923, strawberry cost records were obtained on 35 farms for the years 1921, 1922, and 1923. These data were tabulated and are being combined with records taken in July, 1924, covering costs for 1922,

1923, and 1924. Farm business analysis records were obtained also on 35 farms for 1922 and on 25 farms for 1923. A great many of these studies are made in response to inquiries from particular sections for this information. The cost studies are showing results in many sections where the farm programs are being modified so as to yield larger net results.

#### COST RECORDS OF PRACTICAL VALUE

Cost records have been kept on a large number of products for the purpose of securing authentic information with which to answer the many inquiries received. Farmers are awakening to the fact that haphazard methods can no longer be followed, that the program of production bears a close relation to the costs involved, and that production which can not pay for the costs and yield a profit must in many cases be eliminated. Cost records were kept during 1923 on 100 crops of tobacco, surveys were made on 80 tobacco farms, and complete records were kept on 5 tobacco farms. A preliminary report was published on the cost of raising Virginia dark and bright tobacco in south-central Virginia for 1922. Cost records have been kept also on the cost of producing corn in Indiana and Iowa, on the cost of producing wheat and incomes from farming in eastern Washington and northern Idaho, and the cost and utilization of tractor and horse power in Sherman County, Oreg.

#### DIVISION OF CROP AND LIVESTOCK ESTIMATES

W. F. CALLANDER, *In Charge*

Crop Reporting Board, W. A. SCHOENFELD, Assistant Chief of Bureau, chairman; Research in Statistical Methods, J. A. BECKER; Field Service, C. E. GAGE; Tabulating and Computing Section, F. J. BLAIR; Price Reporting, L. M. HARRISON.

Very marked improvements have been made in the statistical work of this division during the past year. New and improved methods have been devised and the statistical staff has been strengthened by the transfer to Washington of three of the best trained and most experienced field statisticians of the division—one to handle livestock reports, one for cotton work, and one for grain work. It would be desirable to add at least two more commodity statisticians to the Washington force in order to give the various reports the analysis and study that are essential to secure the best results.



### SEMIMONTHLY COTTON REPORTS

One of the most important developments of the past year was the enactment by Congress of legislation providing for semimonthly cotton reports between July 1 and December 1, with the further provision that the reports from August 1 to December 1 shall be issued simultaneously with the cotton ginning reports of the Bureau of the Census. The law provides that these reports shall be issued on the eighth day following that to which they relate. The first report under the new law was issued on July 21. The issuance of these new reports will practically double the number of cotton reports, and it has made it necessary to increase materially the personnel in the field offices in the cotton-producing States because of the fact that not only were additional reports provided for but the date for issuing the regular monthly reports was changed from the 25th of the month to the 1st, and a great deal of investigation and study has been necessary in order to develop a system of pars for dates upon which the department had never issued a report before.

### FALL REPORT ON "INTENTIONS TO PLANT"

In August, 1923, the first fall report on intentions to plant winter wheat and rye was issued, and in March the second spring report on intentions to plant was issued, covering spring-sown crops, with the exception of cotton. These reports, while severely criticized in some quarters, are meeting with general favor on the part of a great many intelligent farmers and have now become an important part of the work of the division. There is no doubt that work of this character which furnishes the farmers information in advance of planting of the general trend of acreage will, when properly understood and used, go far toward bringing about a better adjustment of agricultural production. A provision included in the act requiring semimonthly cotton reports prohibits the department from making intentions-to-plant reports on the cotton crop, and as a result of this provision no report was made this year on the intentions of farmers to plant cotton.

### METHODS OF ESTIMATING ACREAGE

In the report of last year reference was made to the development of a "crop meter" to be used in determining the changes which were taking

place from year to year in acreage. This machine, which is in the nature of a multiple speedometer attached to an automobile, records the number of linear feet along selected areas that are planted to various crops, and a number of these machines have been used during the spring months this year. In practically all of the States where they have been used the field statisticians are enthusiastic about their possibilities, and it is proposed to equip all the field offices with these machines before another year. It is proposed to cover identical roads from year to year, noting the number of feet along each road in each crop, making comparisons and estimating changes based on these measurements. This machine is also being found extremely useful in recording the abandonment of crops, especially cotton. This is done by covering some roads from month to month during the season, measuring the number of feet in cotton. The reduction from month to month indicates the acreage which has been plowed up and put into other crops. It is also extremely useful in recording the progress of work during the season where trips are made frequently over the same routes.

### PRICE STATISTICS

A marked improvement has been made in the handling of price statistics gathered by the bureau during the year. On January 1 a trained statistician was placed in charge of collecting and compiling price data, and the number of reports has been greatly increased. Prices are now being collected monthly, not only on practically all products the farmer has to sell but on about 70 typical articles which he has to buy. A closer study of the spread between farm and retail prices can thus be made. A compilation of price data is being made, which will contain valuable price statistics collected by the division.

### LIVESTOCK REPORTING WORK

**Special hog reports.**—The livestock reporting work has been further developed, particularly in connection with the pig surveys made through the rural carriers. These reports are demonstrating their value and are proving to be very accurate indications of the future supply of hogs at the central markets. A study of the relation between the increase or decrease in the number of sows farrowed and the receipts at the stockyards in

subsequent months demonstrates that the changes in the number of sows farrowed from year to year forecasts almost exactly the change in the number of hogs that will be received at the stockyards the following season. The June survey indicates the number of spring pigs that will be marketed between the following October and May, and the fall survey indicates the number that will be marketed the following summer. The reports on the intentions of farmers to breed sows have also proved their value and are affording the farmers of the country a basis for readjusting their production in order to keep it more in line with the probable demands of the market.

**Special dairy and poultry reports.**—The pig surveys have been expanded to include dairy cows, and a very extensive report was received on June 1 of this year, which indicates that there has been a material increase in the number of dairy cows on farms during the past year, and that the number of heifers between 1 and 2 years of age is relatively high compared to 1919, when the last census was taken. It shows, furthermore, that the number of calves being kept for dairy cows this year is considerably below the number kept last year, indicating that the drop in the price of dairy products is tending to reduce the number of heifer calves being raised for dairy cows. The report shows the most striking increases in North Dakota, Montana, South Dakota, and other far-western States, indicating that these States are gradually diversifying their farm program. It is proposed to make a dairy survey twice a year in connection with the pig surveys, and next December a poultry survey will be included.

#### CATTLE AND SHEEP REPORTS

The work of organizing the information obtained during the past year and a half from stockyards, packing plants, railroads, and other agencies actively engaged in the process of marketing livestock has been well advanced, and at the present time the source of the market supplies of cattle and sheep for four years, 1920 to 1923, inclusive, is substantially established. It is now known where the supply comes from for each season and month during these years, which makes it possible to forecast the probable effect upon market supplies of unusual conditions in different areas. Within the various important livestock-producing

States information is now available also showing the local areas into which and from which cattle and sheep move, the time of movement, and the approximate amount of locally produced and imported stock in the market shipments.

The experience of the past year has demonstrated that much more travel and field work must be done in order that dependable information may be secured and close touch with changing conditions maintained, and to this end the western region has been divided into two areas, and an experienced livestock man will be placed in charge of each area. These men will spend most of their time in travel, securing first-hand comparable information from different States while working in cooperation with the State statisticians.

The work of estimating cattle and sheep on feed has produced satisfactory results during the past year to the extent at least that these estimates have indicated with reasonable accuracy the subsequent trend of marketing. The great handicap in this work continues to be in getting adequate and dependable information from feeders. Work of an educational nature with producers' organizations and through the agricultural press is needed to secure full cooperation in getting information from the men for whose benefit this work is being done.

Additional work was done in securing and releasing information on the weekly and cumulative car loadings of sheep during the feeding season in the important western feeding areas. During the coming year it is hoped to improve this service and through cooperation with various wool-growers' associations to extend it over the balance of the year, thus covering the important western grass movement.

The monthly reports on western livestock and range conditions are proving a source of information as to current conditions in different States and also make possible comparisons with those of last year. After several years' records, are available they should prove valuable indexes of market movements. With the basic information which is being developed as to the origin of livestock supplies and of seasonal market movement it is anticipated that future reports and estimates will be of greater value both because of increased accuracy and the inclusion of more specific details.



### USEFULNESS OF STATISTICS

A rapidly growing interest in and a greater practical use of agricultural statistics by Federal and State extension workers has been one of the developments of the past year. So great has this interest become in some States that the directors of extension have offered office quarters and extra clerical help in order that crop and livestock information may be developed in much greater county detail than the funds of this division permit. Cooperative arrangements to this end have been made with a number of States and in others negotiations are pending.

During the winter two of the best trained agricultural statisticians of this division were detailed to the Extension Service for four months. They visited a number of States in order to carry on extension work in statistics and to demonstrate how such information could be best utilized by county agents and farmers. It was their duty to find out to what extent agricultural statistics now published failed to meet the needs of this large group of agricultural workers. Much valuable information which will aid in developing the work along practical lines was secured.

Cooperative arrangements have been entered into with each State which has a system of crop reporting and all such crop reports are now issued in cooperation with the Department of Agriculture. A joint system of crop reports is now in effect in 27 States.

### CROP REPORTING METHODS

The statistical research section of the division has studied the relationship between crop-condition figures and final yields. For all important crops the data have been analyzed to determine the correlation between crop conditions as reported by the crop reporters of the bureau during the growing season and the final outturn in terms of yield per acre as reported by them at time of harvest. This study has indicated that there is sufficiently high correlation during most of the season to warrant a forecast of yield based upon condition, and that for the United States as a whole, conditions do give a good indication of the direction in which the crop is tending.

In connection with the estimates of cotton an analysis of the relation between condition and abandonment of acreage has been made. Sufficiently

high correlation was found to justify a forecast of abandonment from condition, and within the next few years the bureau undoubtedly will use this information in its crop forecasts.

Study has been given also to the relative merits of various methods of estimating acreage. Wherever a check of acreage, based upon annual enumeration, is available over a series of years, the various methods used in estimating the acreage have been analyzed to determine the relative accuracy of the results. Special attention has been given to the determination of the diversion between the results of certain methods and the actual fact as shown by enumerations, with a view to measuring the statistical bias which exists in certain types of report.

The groundwork has been laid of a systematic study for determining the various factors in crop production which bring about a change in condition of crops as the season advances. All crop forecasts at the present time give an indication of the size of the crop should subsequent influences be average. To assist in making closer and more accurate approximations of the final outturn of crops, it would be desirable to determine the factors which bring about a change in crop condition subsequent to a given date. When these influences are determined and the relative effect of the various influences measured a mathematical interpretation of those factors which are known in advance should assist materially in securing a closer approximation of the probable size of the crop. In addition to the study of the factors which bring about a change in condition, the bureau has begun a study of the relation of certain factors of crop production in the final yield irrespective of the condition at given dates. Under this heading are included not only weather factors but also the effect of economic conditions and factors, such as the quantities of fertilizers used and the relative scarcity of farm labor.

### FOREIGN CROP REPORTING

During the past year one of the statisticians of the bureau spent three months in Europe. While abroad he was a delegate to the International Institute of Agriculture at Rome and obtained first-hand knowledge of the scope of the study and methods used in preparing its reports. He also visited the various statistical bureaus in 11 of the European countries with a view to securing first-hand information of the methods used in compiling



crop estimates, index numbers, and import and export statistics in the various countries. Particular attention is being given to an analysis of the methods used and to the relative accuracy of the results obtained.

#### AGRICULTURAL CENSUS

During the spring months the statistician in charge of the division acted as a member of the department committee which has cooperated with the officials of the Bureau of the Census of the Department of Commerce in drawing up the schedule for the forthcoming agricultural census of the United States as of January 1, 1925. In accordance with an agreement between the Secretary of this department and the Secretary of Commerce, a considerable part of the time of the field staff during the fall and winter months will be spent in aiding the Census Bureau to take the agricultural census.

#### DIVISION OF COTTON MARKETING

ARTHUR W. PALMER, *In Charge*

Classification of Cotton, H. C. SLADE; Preparation and Distribution of Official Cotton Standards, H. C. SLADE; Future and Spot Market Investigations and Cotton Price Quotations, A. M. AGELASTO; Cotton Testing, WILLIAM G. BLAIR; Investigation and Demonstration of Cotton Standards, GEORGE BUTTERWORTH; Cotton Marketing Demonstrations, G. S. MELOY; Research in Cotton Marketing, A. B. COX.

An unusually heavy program of activities in connection with cotton marketing has been carried out during the past year. One of the outstanding accomplishments was the completion of negotiations with the principal cotton exchanges of Europe for the adoption of the universal standards for American cotton. Legislation enacted in March, 1923, making mandatory the use of the official cotton standards of the United States in interstate and foreign commerce, brought about a resumption of negotiations between the Liverpool Cotton Association and the Department of Agriculture which culminated in an international conference held in Washington, D. C., in June, 1923. This meeting was attended by all the most important mercantile organizations in the cotton trade of Europe. In deference to their wishes, the department agreed that the standards for grade and color should be known as the universal standards. In adopting the standards, however, the Liverpool association stipulated that cer-

tain modifications should be made. A second conference, therefore, was called on July 18, 1923, at which delegates from the Liverpool and Manchester associations acted for the European exchanges. The American trade interests were represented also by leading merchants, exporters, spinners, and farmers. The conference recommended several minor changes in the standards and on July 30, 1923, under authority of the United States cotton standards act the Secretary of Agriculture published an order putting into effect the proposed changes, effective August 1, 1924. During May, 1924, Liverpool representatives filed certain criticisms of the copies of the standards which had been shipped by this department. As a result of this criticism the chief of this bureau agreed that representatives of the foreign exchanges should come to Washington and that 15 sets should be passed upon and accepted by the European experts to be used by their arbitration committees in the various exchanges of Europe. Cotton experts from the Liverpool, Manchester, and Bremen exchanges and from the American cotton trade came to Washington on June 16, and as a result of their work 15 sets were accepted against the original set for use by the various exchanges.

Since that time, however, the Liverpool exchange has given notice of its intention to withdraw from the agreement entered into for the use of the universal standards. Negotiations are still pending and it is hoped that satisfactory arrangements can be effected. While under the present law the Department of Agriculture has adequate authority to make the United States standards mandatory in the sale of cotton in interstate and foreign commerce, every effort is being made to secure full cooperation with the European buyers and the movement toward establishing the universal standards as the basis for trading in American cotton in European countries will continue.

The demand for copies of the official standards has been unusually large during the past year, 201 full white sets, 653 fractional white sets, 141 full colored sets, and 133 fractional colored sets for Upland cotton having been shipped to purchasers in this country and abroad, in addition to a large number for American Egyptian cotton and standards for length of staple. The increased use of and the better understanding of the official cotton stand-

ards will lead to more satisfactory marketing of these products.

#### COTTON PRICE-QUOTATION SERVICE

The cotton price-quotation service has been continued along the same lines as in previous years. Under this service accurate quotations are secured on sales of spot cotton from 10 of the principal spot markets. These quotations are given the widest possible publicity through published bulletins, by telephone, telegraph, and radio, and through cooperation with newspapers in the South having a combined circulation of over 1,500,000 copies. A new feature of this work is the development of systematic reception and posting of radio quotations in interior markets. In addition to furnishing authentic, current information on prices, these quotations serve as the basis for the settlement of cotton other than middling delivered on future contracts made subject to section 5 of the United States cotton futures act. This work involves constant supervision in order that the most accurate quotations may be secured and that every means available may be used in bringing this information promptly to the persons interested.

#### COTTON DELIVERED ON FUTURE CONTRACTS CLASSIFIED

During the year in the regular classification work 196,213 bales of cotton were classified by the board of examiners at New York and 87,377 bales by the board at New Orleans. At New York 8,998 bales were submitted a second time for review and in the review the classification of 1,129 bales was changed. At New Orleans 1,165 bales were submitted for review and the classification of 195 bales was changed. In the preliminary sample classification work 2,219 samples were classified by the board at New York and 2,339 bales by the board at New Orleans.

The largest quantity of cotton handled in the regular classification work in any one month by a single board since the beginning of the work in 1919 was handled by the New York board in December, 1923, the figure being 129,815 bales. The volume of cotton classified by the bureau since the inauguration of the work in March, 1919, totaled 1,147,985 bales on June 30, 1924. The classification of cotton continues to be a self-supporting service, and the fees are increased or decreased as the condition of the

funds warrants. The fee for the classification and certification of cotton was increased from 20 cents to 30 cents per bale, effective August 1, 1923.

#### CLASSIFICATION OF SPOT COTTON

Section 4 of the United States cotton standards act, which became effective August 1, 1923, provides that any person who has custody of or a financial interest in any cotton may submit the same to the department for classification. The boards of cotton examiners already established at New York and New Orleans which classify cotton tendered for future delivery were designated to classify all cotton submitted for classification under the cotton standards act. In addition an appeal board of cotton review examiners was established in Washington the duty of which is to hear appeals from the classification performed by other boards appointed under the act. Boards of examiners will be established elsewhere when necessary. During the year 5,810 bales of cotton were classified by the board of cotton examiners at New York and 2,025 bales by the board at New Orleans. No appeals were submitted to the board of review in Washington.

#### LICENSING OF CLASSERS

The inauguration of Government classification of cotton involved in spot cotton transactions and the licensing of cotton classers were of decided advantage to the cotton trade. All cotton classified by the department boards of examiners and by the licensees must, of course, be classified in accordance with the official standards, so that it is hoped the results of the new work when thoroughly appreciated and taken full advantage of by the trade will be the complete dissemination of knowledge of the standards wherever trading in American cotton is carried on and the eventual adoption of the standards as the basis for all trading. Uniformity of classification and the use of a common language with respect to cotton grades in the world's trade in American cotton should go far toward the elimination of controversies and disputes and thus result in decided economies to all interests and in greater returns to the cotton producer for his product.

Authority for the licensing of cotton classers is contained in section 3 of the cotton standards act. The rules of the Secretary under the act require that a fee of \$10 shall accompany each application for a license



and that applicants may be required to submit to a practical examination in the classification of cotton to determine whether they are qualified to classify cotton properly. The rules also provide for the inspection of the records of all licensed classifiers by officers of the department to insure compliance with all provisions of the act with respect to licenses. Applications for licenses were received from 32 persons and licenses had been issued to 12 of these at the close of the year.

#### SPINNING TESTS OF COTTON

The cotton trade has been vitally interested in the results of the spinning tests made on various types of cotton and of cotton handled under various conditions. Tests have been made during the year of new varieties of cotton which are developed in the Bureau of Plant Industry, of the new official grades which became effective August 1, 1924, and of cotton subjected to various treatments. Individual fiber-strength tests have been made for cotton fumigated with sulphur dioxide.

Tests made in cooperation with the Bureau of Plant Industry of Pima or American Egyptian cotton included the "segregation" test, in which the inferior cotton was segregated from the normal run of the field; the "picking" test, in which the first, second, and third pickings were spun separately; the test in which a smooth-seeded variety of Pima cotton grown at Shafter, Calif., was spun against a fuzzy-seeded variety of Pima cotton grown at Sacaton, Ariz.; and a test in which the effect of ginning Meade cotton on a saw gin was checked against the same cotton ginned on a roller gin.

The tests of segregated Pima cotton showed that the "superior" longer staple cotton was less wasteful than the "inferior," but that the yarn produced was slightly weaker than the inferior cotton. As these two factors would largely offset each other, it was apparent that nothing was to be gained by field segregation of Pima cotton grown in the Salt River Valley of Arizona.

In the tests of the three different pickings it was found that the evenness of the yarn from the second picking was slightly better than the first picking and that the third picking was slightly better than the second. The third picking, though, was approximately 1.5 per cent more wasteful than the first and second. It was ap-

parent, therefore, that there was nothing to be gained by separating the different pickings. Tests on the Pima variety of American Egyptian cotton ginned under different moisture conditions showed that the value of this variety is improved by ginning under higher moisture conditions than normally prevail in Arizona. The improvement is noted by the decreased percentage of visible waste and the increased strength of the yarn.

Various other tests were conducted, usually in response to a need for specific information in regard to conditions in a particular locality. This work should be extended until all factors affecting grade and staple and other properties of cotton have been thoroughly studied. Numerous letters from cotton producers and spinners have been received with requests for the solution of problems which they have met, and assistance is being given wherever possible. Particular attention has been given to developing a new method of testing bulk strength of cotton, and it is expected that information along this line can be made public in the near future.

#### COTTON MARKETING STUDIED

The marketing research work has been devoted very largely to four lines of endeavor. The first is concerned with an analysis of the economics of cotton marketing. Particular attention during the past year has been given to a study of the functions of the different kinds of markets and their relationship to each other in such matters as price making, financing, and the physical movement of the cotton. A manuscript giving the results of the greater part of this study is nearly ready for publication.

The second line of study has been devoted to an analysis of the relationships between the cooperative marketing of cotton and marketing as a private business, in order to assist in improving the service rendered grower members, and in assisting the development along sound economic lines. The outstanding result of the studies in this field has been the decision of the cooperatives to adopt the universal standards as their types and to have their classifiers licensed under the authority of the cotton standards act and their work inspected by a classifier from the Cotton Division of the Bureau of Agricultural Economics.

The third line of work is a study of the world demand for cotton. This problem has been attacked by making



an analysis of the per capita consumption of cotton and cotton goods, and of that consumption in so far as possible into that which is used in clothing, in household furnishings, and in industry. This work has proceeded to the point where we are in position to give results for the leading consuming nations for a few selected years.

The other study is a cooperative project with the Cost of Marketing Division. It is devoted to a marginal analysis of the difference between the price of raw cotton and the price the consumer pays for an equivalent amount of cotton in the form of calico, gingham, sheeting, and percale. The major results of this study have been published in the form of a preliminary report. It shows that out of \$1 the consumer spent for sheeting in 1922, the cotton grower got 19.8 cents, 15.1 cents in the case of gingham, and 20.4 cents and 20.1 cents in the case of calico and percale. One of the most interesting facts brought out by the study was that the cost of distributing the cloth from the wholesaler through the retailer was almost twice as large as the amount received by the growers. These costs in 1922 were 36.5 cents for sheeting, 28.1 cents for gingham, 29.6 cents for calico, and 35 cents for percale.

### GRAIN DIVISION

H. J. BESLEY, *In Charge*

Grain Investigations, E. G. BOERNER; Milling and Baking Investigations, J. H. SHOLLENBERGER; Research Laboratory, D. A. COLEMAN; Establishment of Grades, J. H. COX; Grain Cleaning, R. H. BLACK; Bulk Handling, E. N. BATES; Grain Sorghums Investigations, B. E. ROTHGEB; Rice Investigations, W. D. SMITH; Federal Grain Supervision, E. J. MURPHY and G. W. MORRISON, Washington, D. C., and R. T. MILES, general field headquarters, Chicago; chairman Board of Review, O. F. PHILLIPS; Inspection Efficiency, F. G. SMITH; Enforcement, C. L. FINCH; in charge Pacific coast headquarters, Portland, Oreg., B. W. WHITLOCK.

Close study is given to the subject of standardization in order that the Federal standards may at all times meet the needs of producers and the trade. Whenever it appears, after careful consideration and after all interests have been given an opportunity to be heard in the matter, that a change in the grades would be beneficial, such change is ordered. During the past year a number of delegations appealed to the department for certain changes in the Federal grain

standards. A number of informal conferences were held in Washington and at various points in the field, and hearings were held throughout the West at which wheat growers were given an opportunity to present any changes which they desired in the grades. As a result the Secretary of Agriculture, under date of May 17, 1924, gave public notice of a number of changes in the grain grades, all of which were to become effective August 15, 1924.

Minor changes were made in the grades for corn, wheat, and oats, which provided that grain containing live weevils or other injurious insects was to be graded in accordance with its numerical grade and that the word "Weevily" be added to and made a part of the grade designation. For example, "No. 2 Yellow Corn, Weevily." Such grain had formerly been designated "Sample Grade."

The standards for rye were changed so as to permit a tolerance of 0.1 per cent of heat-damaged kernels in grade No. 1, and 0.2 per cent of heat-damaged kernels in grade No. 2. The standards as originally promulgated permitted no heat-damaged kernels in these grades.

The definition for wheat was changed so as to exclude Polish and Poulard wheat from being classified as wheat under the standards, and the definition for "Cereal Grains" was likewise amended to include Polish and Poulard wheat.

The definition for "Treated wheat" was changed so as to require wheat to be tagged "Treated" whenever from an inspection standpoint it has been scoured, limed, sulphured, or in any other way treated so that its true quality would not be reflected by the numerical grade designation alone.

The standards for Soft Red Winter wheat were changed so as to require all wheat of this class grown west of the Rocky Mountains to be graded "Western Red." In this connection the test weight per bushel requirement for each grade of Western Red was raised 2 pounds.

A new grade for wheat of the class Hard Red Spring was established. This grade known as "No. 1 Hard Spring" is designed as a top or premium grade. It has a test weight per bushel requirement of 60 pounds and must contain at least 85 per cent dark hard and vitreous kernels. Otherwise the requirements are the same as for grade No. 1 of the subclasses of Hard Red Spring wheat.

The requirements for grades Nos. 1 and 2 of the class Hard Red Spring and Hard Red Winter wheat were changed so as to permit 5 per cent of White wheat in grade No. 1 and 10 per cent of White wheat in grade No. 2 of these classes. Prior to this change grade No. 1 permitted only 2 per cent of White wheat and grade No. 2 permitted only 5 per cent of White wheat.

Definite grades for Mixed Durum wheat were established. The requirements for Mixed Durum are 70 per cent or more of durum wheat other than the variety Red Durum and not more than 5 per cent of Soft Red Winter and White wheat whether singly or combined. The numerical grade requirements for Mixed Durum are the same as for Mixed wheat.

#### SUPERVISION AND INSPECTION METHODS

Merchandising of grain is constantly becoming more specialized and technical, which forcefully suggests the necessity for constant improvements in supervision and inspection methods and interpretations and revision of standards to meet these developments. Therefore, it is incumbent upon the bureau to broaden its research work in order to discover the facts underlying the questions and problems presented. The present outstanding research problem is in connection with the content and quality of gluten in wheat in view of the increasing importance which the trade attaches to this factor. Comparisons were made during the year of several laboratory tests used for the purpose of identifying gluten quality in wheat. It was found that gluten quality can be determined by several tests, the "viscosity test" showing the greatest promise. To go further, however, and predicate the bread-making quality from such tests is a difficult matter, inasmuch as bread making is the result of many factors of which gluten quality is only one. A report on the subject of protein and gluten as related to wheat and wheat quality was prepared and published in a mimeographed pamphlet. Tables for converting crude protein and ash content of the grain and its products to a uniform moisture base were developed and prepared for publication. These tables will be of value in providing a fairer and more uniform base for the evaluation of cereals and their products wherever protein and ash content are given consideration.

#### MILLING, BAKING, AND CHEMICAL TESTS

Milling, baking, and chemical tests are becoming more necessary to the marketing of wheat. There are no standard methods employed at present by the various agencies making such tests for the grain and flour trade, and in order to bring about improvement and uniformity in the making of these tests a description of the apparatus and of the methods used by this bureau was prepared and published. The methods and apparatus described in this bulletin are being adopted very largely by cereal chemists and experimental millers and bakers.

Over 480 milling and baking tests and over 1,200 chemical tests were made on various varieties of wheat for the Office of Cereal Investigations, Bureau of Plant Industry. The results of these tests were used by that office in connection with its work of breeding and selecting better varieties of wheat. Due to the market demand for a desirable yellow color in durum wheat, chemical tests were developed for making the color determination. This information was given to the Office of Cereal Investigations for use in developing desirable varieties of durum wheat.

#### HEAT DAMAGE DETERMINED

Physical, chemical, milling, baking, and storage studies were made to determine the intrinsic value of wheat in varying conditions of damage caused by heat fermentation. The information obtained from these investigations was used in determining the proper grading of grain under the enforcement of the grain standards act. Field studies also were made to determine the causes of heat damage. The information obtained clearly indicates that much of the wheat harvested with "combines" and of that threshed early from shocks has too high moisture content for safe storage in the farm bins as ordinarily constructed. The use of combines and early threshing reduces the costs, but a safe storage system for moist wheat is essential to complete the success of these newer methods of harvesting. Experiments were conducted to determine the extent of fermentation when damp wheat was stored in bins provided with various types of ventilators. The results obtained show that a simple and inexpensive system of ventilation for bins will prevent



heating of the grain while in storage on the farm.

### SMUTTY WHEAT SITUATION

A study was made of the smutty wheat situation in the Pacific Northwest in connection with changes requested in the wheat standards. A large number of millers and elevator men in the Pacific Northwest were interviewed and numerous samples of wheat were collected for milling and baking tests, as well as approximately 100 samples containing various amounts of smut. Microscopic examinations were made of the smutty wheat and of its flour product for smut spores. Based chiefly on the results and information obtained from these investigations, changes were made in the official standards for treated wheat.

### ADVANTAGES OF CLEAN WHEAT

Tests were made to determine the milling and baking qualities of wheat containing admixtures of eight different kinds of weed seeds of the so-called inseparable type commonly found in wheat. Charts illustrating the results were made up and distributed to some of the State agricultural officials who reported having used them to good advantage in inducing farmers to produce cleaner wheat and in educating millers regarding the importance of clean wheat. A request has been received from the extension service of the department to have a number of these charts made up and distributed to county agents for use in a campaign to improve the quality and cleanness of wheat produced and marketed.

### GRAIN-CLEANING MACHINES DEVELOPED

Two successful types of grain-cleaning machines for use at the threshing machine were perfected. One of these types, which is a portable cleaner mounted on a truck on which also are mounted a gas engine and two grain elevators, is especially designed for cleaning spring wheat and rye. This cleaner was tested at various points in North Dakota, South Dakota, and Minnesota, and it was found that it cleaned the grain as fast as threshed, and delivered the clean grain into one wagon box, wild oats into a second box, and the fine seeds into sacks. Sixteen lots of grain containing 23 to 24 per cent of dockage were cleaned to a dockage-free basis.

In addition to removing the dockage, the cleaner raised the grade of several lots by removing the excess "inseparable foreign matter." The results of these tests were entirely successful and this type of cleaner is now being manufactured and put on the market. The grain cleaned with the cleaners sold for a substantial premium over similar grain which had not been cleaned. In connection with the grain-cleaning investigations a poster entitled, "Clean Your Own Grain on the Farm" and a mimeographed report describing the operation of the portable cleaner were prepared and distributed, as well as a number of press releases and a scenario for use by the Extension Division.

### STANDARDS FOR OTHER GRAINS

During the year progress was made in the standardization of flax, barley, milled rice, rough rice, and brown rice. The grades for milled rice, published as permissive standards, effective August 1, 1923, have been adopted and are now in use by the inspection departments of a number of large associations and State departments as the basis for grading milled rice. The permissive grades for rough rice in modified form have been adopted by the California State Department of Agriculture.

Approximately 1,400 flax samples were analyzed, milled, and tested for oil content with a view to establishing official standards for flax. Due to the necessity of having a means for determining rapidly the oil content of flaxseed, a short method by which this test can be made in a few minutes was perfected to replace the old method which required 48 hours.

In compliance with the demand from the grain trade to have the official oat standards extended to include grades for "mill oats and feed oats" (oats heavily mixed with wild oats) investigations were begun during the year with a view to preparing these new grades.

Numerous other tests were made during the year, including tests for ash and crude protein in connection with the enforcement of the grain standards act. A large number of bulletins, posters, and charts have been prepared and much educational work carried on.

### GRAIN STANDARDS ACT

Very satisfactory progress was made during the year in the administration



of the grain standards act. Closer supervision of inspection was maintained and fewer violations of the regulatory provisions of the law were noted. A total of 24,905 appeals were called from inspections performed by licensed inspectors. Approximately 45 per cent of the appeals called on all grains were sustained; that is, the inspectors' grades were changed and their certificates were superseded by Federal certificates showing the correct grade. This appeal work continues to be heavy and was marked during the year by the tendency to call appeals on large shipments of cargo grain. In addition to the numerous appeals on carload lots, approximately 18,000,000 bushels of grain were appealed on vessel loadings. In the case of sustained appeals no charge is made to the appellant, but on appeals not sustained, fees are collected and covered into the Treasury as miscellaneous receipts. The sum of \$37,048.20 was covered into the Treasury during the year from this source.

#### BRANCH OFFICES

Administration of the grain standards act in the field was directed, under general supervision from Washington, by general field headquarters at Chicago and Pacific coast field headquarters, Portland, Oreg., through 6 division supervisors and 31 district offices of Federal grain supervision. District offices of Federal grain supervision are located in the following cities:

Baltimore, Md.  
Boston, Mass.  
Buffalo, N. Y.  
Cairo, Ill.  
Chicago, Ill.  
Cincinnati, Ohio.  
Denver, Colo.  
Duluth, Minn.  
Fort Worth, Tex.  
Galveston, Tex.  
Indianapolis, Ind.  
Kansas City, Mo.  
Memphis, Tenn.  
Milwaukee, Wis.  
Minneapolis, Minn.  
Nashville, Tenn.

New Orleans, La.  
New York, N. Y.  
Ogden, Utah.  
Oklahoma City, Okla.  
Omaha, Nebr.  
Peoria, Ill.  
Philadelphia, Pa.  
Portland, Oreg.  
San Francisco, Calif.  
Seattle, Wash.  
Sioux City, Iowa.  
Spokane, Wash.  
St. Louis, Mo.  
Toledo, Ohio.  
Wichita, Kans.

Branch offices were operated also at Norfolk Va., Hutchinson, Kans., Superior, Wis., and Tacoma, Wash. A representative of Federal grain supervision was stationed throughout the year at Louisville, Ky., and at St. Joseph, Mo.

#### DIVISION OF HAY, FEED, AND SEED

W. A. WHEELER, *In Charge.*

Hay Marketing Investigations and Market News Service on Grain and Hay, G. A. COLLIER; Feed Marketing Investigations and Market News Service, G. C. WHEELER; Seed Marketing Investigations and Market News Service, G. C. EDLER; Hay Standardization, E. C. PARKER; Hay Inspection Service, K. B. SEEDS; Broomcorn Marketing Investigations and News Service, G. B. ALGUIRE; Standardization of Beans and Peas, J. E. BARR.

#### TIMOTHY AND CLOVER HAY GRADES REVISED

In response to a demand from the hay interests of the eastern part of the United States the revision and simplification of the United States grades for timothy and clover was undertaken. The standardization of hay presents problems which are extremely difficult of solution. Hay can not be tested and graded in a rapid manner by any of the mechanical methods such as those available for grain. Foreign material and damaged portions can not be separated rapidly, nor can moisture and nutritive value tests be applied quickly to samples. Hay is bulky, its component parts impractical of quick separation, and its quality and relative feed value can be measured only by those characters and factors which are visible, and which are correlated with intrinsic value. Because of these facts intensive laboratory work and much consultation with producers and dealers has been necessary. A large number of bales of timothy and clover hay selected from many markets were analyzed and studied in the laboratory and simple practical methods were devised for grading the hay according to the percentage of natural green color and the percentage of foreign material content. Definitions and terms for grading hay were worked out which are definite and yet which follow the general methods well known to producers, dealers, and consumers of hay. The work resulted also in the simplification of the standards for timothy and clover hay so as to include 29 classes and grades rather than the former number of 49 classes and grades.

The results of the investigations conducted by the bureau were submitted to the public at a hearing held in Washington, D. C., January 22, 1924, at which hearing a representative

group of delegates was present from the important timothy and clover markets, country shipping points, State marketing bureaus, and the Quartermaster Corps of the United States Army. The proposed revised grades were thoroughly discussed and it was the sense of this assembly that the grades as revised were simple, practical, workable, and definite. At the close of this hearing the following resolution was introduced by a representative of the St. Louis market and unanimously adopted:

'That this conference congratulates the Bureau of Agricultural Economics, United States Department of Agriculture, on the progress made in simplifying the grading of hay to a more practical basis. That it approves of the work thus far accomplished; and further, that it is the sense of this assembly that the grades as amended are adapted to the marketing of hay and that we hereby indorse them and commend them to the trade.

In response to many requests received from various hay markets, country shippers, and hay producers, a circular was prepared and published (Department Circular No. 326) in which the revised United States grades for timothy hay, clover hay, clover mixed hay, and grass mixed hay were described in popular language. Included in this circular is a short treatise on haymaking, baling and loading methods essential to the marketing of high-grade hay, which furnishes instructions to producers and shippers of hay as to the best practices to follow in producing hay to meet the requirements of the United States grades. This circular has been sent to a very large number of producers, dealers, and consumers of timothy and clover hay. Various farm papers have assisted further in giving publicity to the grades and to the treatise on hay marketing.

#### ALFALFA, WILD HAY, AND JOHNSON GRASS GRADES FOR 1925

A strong demand has been made by shippers' organizations, State marketing departments, several large terminal markets, and country shippers for alfalfa and wild-hay grades. The demand has been particularly insistent from cooperative organizations which ship alfalfa hay in quantity, from western alfalfa growers, and from western State marketing bureaus. The demand for Johnson grass grades has been very insistent also from the Southern States. The leader of this division presented general plans for alfalfa-hay standardization throughout the various

Western States, and many resolutions were passed by shippers' organizations and hay markets supporting the plans of the division and offering cooperation and assistance. It is expected that the research work can be completed on the grades for these three types of hay by February or March, 1925, at which time public hearings will be held at south-central points in the South Atlantic States, also at St. Paul, Kansas City, and other central points in the Western States.

A branch laboratory has been established at Kansas City, and cooperative laboratories at St. Paul, Minn., and Auburn, Ala., in which the work on alfalfa, wild hay, and Johnson grass grades will be carried on. Kansas City is the largest hay market in the United States and is conveniently located for securing the large number of samples required and for the training of inspectors. Cooperative work is being conducted on hay standards also with a large number of State experiment stations and other agencies.

#### HAY INSPECTION SERVICE GROWING

Although the first half of the year was devoted largely to the study and revision of the timothy and clover grades, very satisfactory progress was made in inspection work. At the beginning of the year 7 Federal hay inspectors were at work—2 in Chicago, 4 in terminal markets along the Atlantic coast, and 1 in shipping territory in central New York. Arrangements were completed early in the year whereby all hay received by members of the Chicago Hay Exchange was to be inspected under Federal supervision. As soon as definite information could be given out with regard to the changes in the grades the training of inspectors to carry on the work was resumed. The inspectors who were already in the field were called to Washington for a short course covering the revision in the grades, and a class was held at which training was given to inspectors for Cleveland, Ohio, Norfolk, Va., and Birmingham, Ala.; shipping-point inspectors for Wisconsin, Maryland, and New Jersey; a representative of the Alabama extension service; and representatives of the Quartermaster Corps of the Army. Training was given later to eight officers of the Army Veterinary School in Washington, D. C.

Arrangements were completed for another school to be held in August, 1924, at which time four additional inspectors will be trained for Wis-

consin and one each for Maine, Virginia, North Carolina, and the city of Boston. Representatives of several additional State agricultural colleges, the Canadian Department of Agriculture, and some of the large hay dealers have also indicated their intention to attend this school in order to familiarize themselves with the Federal hay grades. An inspector will also be stationed at the new laboratory in Kansas City in the near future. The hay-inspection service will then have 11 shipping-point inspectors located at 10 terminal markets.

Reports received indicate that as soon as Federal grades for alfalfa and prairie hays are issued there will be a heavy demand for inspection service at all points in the West. It is estimated that if these grades become available early in 1925 from 75 to 100 new inspectors will be trained and assisted in starting their work at points west of the Mississippi River, and 15 or 20 more inspectors will be placed in the East and South.

The Inspector's Handbook was revised this year and a new section added which contained an explanation of the methods of applying the Federal grades for hay. The handbook now is a 73-page mimeographed folder which contains under one cover all the information which an inspector ordinarily needs in the conduct of his work.

#### PREPARING GRADES FOR BEANS

A project was organized to study marketing conditions and to collect data with a view to establishing uniform standards for all classes of dry edible beans of commercial importance, as well as soy beans, cowpeas, and Canada field peas. This work was undertaken in response to repeated requests from various agencies, including State or regional commercial bean organizations, agricultural colleges, and manufacturers. Much of the preliminary work has been done and tentative grades for the various classes of dry edible beans and soy beans will be submitted to the public during the current fiscal year.

#### SEED MARKETING IN EUROPE

Many of the most important seed markets in Europe were visited by a representative of this bureau for the purpose of gaining a better insight into the production, consumption, and marketing of seeds in France, Germany, Italy, Austria, Hungary, Czechoslovakia, Poland, Denmark, Belgium,

Holland, England, and Scotland. During recent years the United States has had to import more red clover seed than it has exported, and the location of best sources of supply of seed adapted for general sowing in this country has been of great importance. On the other hand, the seed trade, including growers as well as dealers, is anxious to know where it can sell more of certain kinds of seed such as timothy, redbud, Kentucky bluegrass, and meadow fescue. Methods of doing business, direction of movement of seeds from surplus-producing sections, preferences shown for certain qualities of seeds or seeds from certain sections, nature of complaints lodged against American seedsmen, names of most reliable seedsmen and seed growers' organizations, and methods of operation of seed-control stations were some of the other things that were studied.

The seed business is international, and information from the United States alone is not a reliable indicator of the trend of future seed prices for some kinds of seed. Seed production and demand in Europe and elsewhere may affect prices in the United States more than the size of our crop. To illustrate, the 1923 crop of red clover seed in the United States was only about half as large as the 1922 crop; nevertheless, prices in the spring of 1924 were only a little higher than during the previous year, due to the fact that Europe produced a large crop in 1923. For this reason it is highly necessary that information regarding European production and demand for seeds be made available to producers in the United States as soon as possible. In order that such information may be obtained one or more correspondents at leading markets were obtained by the representative of this bureau. These correspondents will submit monthly reports regarding seed crops and trade conditions in their countries in return for which they will receive seed reports issued by this bureau.

#### MIMEOGRAPHED REPORTS ON SEEDS

In the past only a few seed reports were mimeographed. Printed publications were depended upon almost entirely for the dissemination of seed-marketing information. It had become apparent that the printed information ordinarily does not reach the public in time to be of greatest value, so during the past fiscal year practically all of the seed reports were mimeographed and distributed immediately. These reports met with hearty indorsement by the seed trade. In



addition a number of periodic reports were published relative to production, movement, shipments, and other data.

#### NEW GRAIN-MARKET SERVICE

A grain-market news service was started in order to give farmers timely information relative to the grain-market situation and the factors causing price changes and market trends. Contacts were established with market agencies in the important grain markets east of the Rocky Mountains and reviews describing the local grain-market situation are obtained regularly each week from them. At Minneapolis, Chicago, and Kansas City the men in charge of the field offices of the Hay, Feed, and Seed Division furnish the desired reports. These weekly reviews are forwarded to Washington by telegraph each Friday night, and the information contained in them is used in the preparation of The Weekly Grain Market Review each Saturday morning. Timely foreign crop and market information and the latest official estimates of the United States grain crops are also incorporated in these reviews.

In order to give as wide distribution to these reviews as possible, the service is being introduced to daily and weekly farm papers throughout the agricultural States. On October 1, 1924, the total circulation of the weekly reviews and the monthly reviews carried by the farm journals and prepared from the same material was approximately 4,500,000. To insure the prompt publication of these weekly reviews, they are forwarded by leased wire to the branch offices at Minneapolis, Chicago, and Kansas City and mailed from them, and also from the Washington office Saturday afternoon, so as to be available for publication on Monday morning or evening in most of the papers using this service east of the Rocky Mountains. The weekly reviews are also forwarded by telegraph or mail to about 30 of the large radio-broadcasting stations in the agricultural States and are broadcast by them either on Saturday or with the early market reports on Monday. Grain-market reviews are also incorporated in the marketgram service, and weekly grain-market reports are furnished regularly for Crops and Markets.

#### MARKET NEWS SERVICE ON HAY

Greater publicity was obtained for the hay-market reviews. In addition to the reports prepared for Crops and

Markets, special weekly reviews similar to the grain-market reviews are being prepared and distributed through the farm press in the same manner as the grain reviews. They are also broadcast by a number of radio stations and are being made available to a large number of farmers and others interested in the marketing of hay. Many favorable comments have been received as to the value to the farmers of the country of the grain and hay market news service.

#### NEW FEED-MARKET SERVICE

In addition to the regular weekly reviews and prices of 13 feedstuffs at 15 important markets published in Crops and Markets, the Federal feed market reporting service was extended during the year through cooperation with various State departments of agriculture to include special reports for distribution to consumers and others interested in the marketing of feed. Cooperative arrangements have been made with Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and Pennsylvania. Special reviews, together with basic prices for the principal feeds, are furnished these States each week direct from the Washington office. Similar arrangements have been completed with the State departments of agriculture of Minnesota, Wisconsin, Iowa, and Nebraska through the efforts of the Minneapolis office of this division, which was opened during the past year. The reports broadcast by radio are a new feature and appear to be even more popular than the printed reports because of their timeliness.

#### DIVISION OF LIVESTOCK, MEATS, AND WOOL

CHARLES V. WHALIN, *In Charge*

Market News Service, J. A. BURGESS; Field Supervisor, E. W. BAKER; Livestock Market Investigations and Market Movements, C. A. BURMEISTER; Livestock Grade Standardization Committee, C. E. GIBBONS, D. J. SLATER, E. W. BAKER, and J. S. CAMPBELL; Purebred Livestock Market Investigations and Prices, L. B. BURK; Meat Grade Investigations, Meat Grade Standardization, and Meat Grading Service, W. C. DAVIS; Market Research and Analysis, C. E. GIBBONS; Wool Market Investigations and Wool Standardization, G. T. WILLINGMYRE.

The market reporting service on livestock, meats, and wool made marked progress during the past fiscal year. Increased appropriations made possible the opening of five additional offices at important livestock marketing centers and the inauguration of a mar-

ket reporting service on wool. The hearty cooperation of the trade and of commercial news agencies aided materially in making available to the livestock producers more complete and dependable market information than ever before.

At the beginning of the fiscal year this division had branch offices with leased-wire connections for reporting the wholesale meat trade in Boston, New York, Philadelphia, and Chicago, and the livestock markets at Chicago, Kansas City, Omaha, East St. Louis, St. Paul, Fort Worth, and St. Joseph. In addition to the offices having leased-wire connection, the livestock market reporting offices at San Francisco and Los Angeles were in operation. The St. Joseph office was closed July 31 on account of the withdrawal of financial support by the Missouri State department of agriculture, necessitated by a reduction in the appropriation for their work.

The increase in the appropriation for the market news service, together with some financial assistance from State agencies and the exercise of strict economy in operation, made it possible to open new offices for reporting the livestock markets at Denver, Salt Lake City, Ogden, North Portland, Jersey City, and at Sixtieth Street, New York City. The Jersey City livestock market is of particular importance to producers in the Eastern and Southeastern States, and is the market center for a large number of lambs produced in Virginia, West Virginia, Kentucky, and the Eastern States. The Sixtieth Street market provides an outlet for livestock produced largely in New York State. A livestock market reporter was added to the staff of the New York office to cover both the Jersey City and the Sixtieth Street stockyards. The reports have received widespread dissemination through the columns of the metropolitan press and in addition are distributed through the press associations, telegraph companies, by radio, and other agencies in a manner similar to that in other markets in which the division is represented. The work at Atlanta was expanded to provide a complete market reporting service, and a partial service was arranged for Baltimore, Indianapolis, and St. Joseph. The extension of the bureau's leased-wire circuits to San Francisco, Fort Worth, and Atlanta made this service available to all the offices of the division except Los Angeles and Portland.

## DISSEMINATION OF INFORMATION

Careful consideration was given to the methods for improving the distribution of information in order that it might be available at the earliest possible moment to those interested. To this end the radio-broadcasting stations were utilized to the fullest possible extent, the result being that there were few if any localities in the United States where up-to-the-minute market news of dependable character could not be obtained. Contacts with the commercial news distributing agencies were broadened and strengthened. The various press associations as well as the commercial news departments of the telegraph companies requested a much greater volume of information than had ever been used previously in order to meet more adequately the needs of their members and subscribers. Trade papers representing the livestock, meats, and wool industries published an increasing amount of the bureau's market reports and have been warm supporters of the service.

The following mimeographed reports are distributed by the various branch offices:

- Daily report of meat trade conditions and wholesale prices.
- Daily livestock market summary.
- Daily wool market report.
- Weekly review of meat trade conditions.
- Weekly review of livestock markets.
- Weekly review of Boston wool market.
- Weekly report of the Brighton livestock market.
- Weekly livestock market statistics (Chicago).
- Weekly livestock market statistics (St. Paul).
- Special weekly livestock market reports for the press.
- Monthly summary of cold-storage holdings of frozen and cured meats and frozen and mild cured fish.
- Special reports prepared by the Division of Crop and Livestock Estimates on the livestock situation in producing areas.
- Quarterly wool stock report.
- Receipts and disposition of livestock at stockyards. (Totals and comparisons.)

It is estimated that more than 4,000,000 mimeographed reports were distributed during the fiscal year. In cooperation with the Division of Crop and Livestock Estimates many reports on production and supplies of livestock were issued through the various branch offices. These releases, supplementing this division's reports on market information, prices, and movements of livestock, meats, and wool, were invaluable as a means of furnishing information from the standpoint of both production and marketing.

### WOOL MARKET REPORTING SERVICE

The opening of the wool market reporting office in Boston in July was one of the outstanding developments of the year. The need for Government reports on wool had been felt for some time, but it had not been possible until the past year to put this into effect on a basis comparable to the service on livestock and meats. Boston, as the most important wool-marketing center in the country, was selected as the place for the inauguration of the service, and in October the first weekly reports were released. At the request of the Associated Press, a daily service was started in February and this information is distributed to member papers over the leased wire circuits of that organization.

The weekly reviews as issued from various branch offices each Wednesday include a brief summary of the outstanding events occurring during the week, comments on domestic fleece and territory wools and foreign wool markets and price quotations. The reports on territory wools were supplemented during the shearing season in the Western States by semimonthly press releases covering prices paid to growers, selling prices of pooled clips, reports on the condition of the wools in several States, progress of shearing, condition of the lamb crop, and other pertinent information. The weekly reports issued from the Boston office contained such information as price quotations on foreign wools and the amount and trend of exports and imports. A weekly report on tops and yarns was also issued, which is of particular value to manufacturing interests and dealers. Both of these reports are sent to all parts of the country on special request in order to serve the interests of those who desire more complete information than that contained in the regular weekly reviews. A number were also sent to English and Argentine wool interests. Daily reports on trading and price quotations on certain classes and grades of domestic fleece wools are sent over the leased wire and distributed from various branch offices.

### STANDARDS FOR LIVESTOCK AND DRESSED MEATS

Educational work was the leading feature of the standardization program for the past year. Intense interest in the subject was displayed by producers and members of the trade

and demand was made for further information. At the request of stockmen, livestock-grading demonstrations were held in California, Nevada, Utah, Arizona, and Colorado in cooperation with the Bureau of Animal Industry and the Federal and State extension services. Approximately 85 demonstrations were held at central points where herds and flocks were available and where it was convenient for stockmen to assemble and observe the actual sorting and grading of the animals. The primary object of these demonstrations was to point out to rangers the different classes and grades found in their herds conforming to the standard market classes and grades recognized by the department, and to call to their attention the differences in quality, conformation, and finish which are the factors that determine the grade and market value of an animal. No work which this division has ever attempted has been so well received or achieved such gratifying results as these grading demonstrations. Stockmen were emphatic in their indorsement, and requests have been received from other States for similar demonstrations. By pointing out to the producers the types of animals which have the greatest commercial value and the reasons therefor, it is believed that the production of better livestock will be stimulated.

### MEAT-GRADING DEMONSTRATIONS

Meat-grading demonstrations were held for the benefit of the officials of the Army, Navy, and Marine Corps who are responsible for buying meat for their respective services. Similar demonstrations were held in Philadelphia for the benefit of the Pennsylvania State Stewards' Association. At the request of the management of one of the leading chain-restaurant companies, several meat-grading demonstrations were given for the benefit of its employees. This company has adopted the standard specifications for the purchase of meats, and all the meats used in its restaurants in New York, Boston, Philadelphia, Norfolk, and Washington are bought subject to official grading by the graders of this division.

### MEAT-GRADING SERVICE

The meat-grading service inaugurated for the United States lines and the laid-up fleets of the Shipping Board early in 1923 was carried on with the most satisfactory results,



and, effective July 1, 1924, the service was extended to include the fleet at San Francisco. New York City is the center of the meat-grading service. Among those served are several commercial firms and State institutions, the Munson Steamship Lines, and a large general restaurant system. The meat specifications prepared by the division are in use generally where the grading service is conducted and in many public institutions. As a result of the service, substantial savings have been made in many instances and a uniform quality of production assured. One firm reported having received a refund of \$420 on a carload of dressed cows because of difference in quality, while another reported a saving of \$508 on one lot, both attributable to the meat-grading service.

Rules and regulations governing the meat-grading service under the food products inspection act have been prepared and will be printed shortly. Grade certificates and forms to be used in connection with this service have been prepared for use at all points where grading is done.

A special study involving a survey of methods and practices in selecting, grading, and handling export cuts of pork was made in 32 packing plants in this country and Canada. The results of this study were embodied in a report covering the type of hog most desired for export cuts, as well as differences in methods of handling and curing bacon for export trade. In this study differences in methods in the United States and Canada were given special attention. Tentative specifications for export cuts of pork based largely on the Canadian method were prepared and will be offered to the trade in the near future.

A special study was made to determine the relation existing between the grades of cattle and the grades of beef derived therefrom. Carlots of fat steers were graded in the stockyards by buyer, seller, and bureau representative, and all special features, both favorable and unfavorable, relating to each lot were noted and recorded. The same procedure was followed in the cooler, where the man in charge of the cooler, the head beef man, and the bureau's representative graded the carcasses and noted special features. The records of the grading of the live animals were then compared with those of the grading of the carcasses. In almost every case the deficiencies and merits of the live animal were very noticeable in the carcass.

#### RESEARCH WORK PLANNED

The foundation is being laid for a constructive research program which will be of value in studying the problems of orderly marketing and the adjustment of production to demand. Both the market news service and the investigational work furnish an inexhaustible supply of statistical data. These data are compiled, summarized, and analyzed for immediate publication as current information, and later they serve as a basis for long-time studies of price trends, production, consuming demand, and market movements. They were of special value in preparing the agricultural forecasts relating to livestock and were used in making special studies of the swine situation and the statistical position of the sheep and wool industries.

#### METHODS OF MARKETING LIVESTOCK

A preliminary survey was made of the beef-cattle market situation in southwest Virginia to ascertain the problems involved and the remedial measures necessary to effect improvements. The results indicated that Virginia producers were not meeting consumers' demands, and plans have been made to conduct an intensive study of the problem during the next marketing season. Methods of marketing sheep and lambs were studied briefly in connection with the lamb standardization campaign. Methods used in marketing the California spring lamb crop were given careful attention and assistance was rendered to California producers in marketing their lambs. A survey of marketing problems of the western stockmen was made in connection with the live-stock-grading demonstrations held in the range States. A number of other studies were carried on and recommendations made wherever it was found that improvements might be effected.

#### LAMB-IMPROVEMENT CAMPAIGN

Gratifying progress was made in the campaign to improve and standardize the quality of eastern lambs and bring about more orderly marketing of the product. The work was carried on in cooperation with the agricultural extension service of Virginia, West Virginia, and Tennessee, and with a committee representing the trading interests of the Jersey City market. Demonstrations were conducted by extension workers to show

producers how the quality of lambs could be improved by using better breeding stock, following improved methods of sheep husbandry, and docking and castrating ram lambs. Selected shipments of lambs were followed through the market by this division and complete information obtained regarding grade, selling price, carcass yield, and other factors which would show the relative value of various grades of lambs. This information was forwarded to the shippers and extension workers, thereby permitting them to see the market's actual appraisal of lambs of different quality. Expressions from the sheep producers indicate that a large part of the lamb crop of 1925 will be standardized and the number of bucky lambs materially reduced. One of the most constructive achievements of this campaign was that of getting the trade interests of Jersey City to give more attention to sorting lambs and buying them according to grade. At a conference held in New York City on June 20, 1924, resolutions were adopted by buyers and sellers to the effect that in the future lambs would be sorted and sold according to their respective merits. In carrying out these resolutions, the trade makes it possible for producers to learn just what the market demands and how it discriminates against inferior quality.

#### OFFICIAL WOOL STANDARDS

The wool grade standards developed in this bureau were made the official standards of the United States effective July 1, 1923. Shortly thereafter distribution of sets of samples representing these standards was begun. The establishments to be supplied first were the warehouses licensed under the United States warehouse act which are compelled to employ the standards when grading wool stored with them. Other agencies and institutions, including wool dealers and manufacturers, wool growers and growers associations, and educational institutions, have been supplied with sets as rapidly as practical forms could be prepared.

#### INTERNATIONAL WOOL STANDARDS PROPOSED

Early in the fiscal year a wool-marketing specialist was sent to England to confer with the British wool authorities relative to wool standardization and the possibility of effecting a correlation between the British and the United States wool grades. Such a correlation seemed particu-

larly advisable because much of the wool imported into the United States comes in under the British classification and much of the trading here is done on the basis of these grades. Furthermore, the British classification is not uniformly interpreted on both sides of the Atlantic. There being no British official wool standards, leading representatives of the industry were requested to furnish samples which would represent the British commercial grades. A committee representing the British Wool Federation was designated to review the grades and make determinations of the average Bradford qualities as regards diameter of fiber. In order to establish complete correlation, it was found necessary to make changes in both the United States and the British classifications. Through a reduction in the range of several of the grades, the grades of the United States standards were increased to 12 and the spread of the Bradford grades reduced so as to make the sets correspond in numbers. Representatives of the Bureau of Standards and the Associated Textile Manufacturers assisted with the correlations. Three master sets of the correlated samples were prepared, one of which was shipped to England and the others retained by this department and by the Bureau of Standards.

#### MOHAIR STANDARDIZATION WORK

Further investigations in connection with the development of mohair grade standards were conducted in Texas and Oregon during the year. Early in the fiscal year the Southwest Farm Bureau Wool and Mohair Association of Texas employed a grader recommended by this bureau, who graded the mohair assembled by it in accordance with the proposed grades. While the quantity of hair graded was small, the returns from the graded lots indicated that the grades were satisfactory.

#### DIVISION OF DAIRY AND POULTRY PRODUCTS

ROY C. POTTS, *In Charge.*

Dairy Products Investigations, D. L. JAMES; Poultry Products Investigations, J. M. BORDERS and R. R. SLOCUM; Market News Service, L. M. DAVIS; and Dairy Inspection Service, C. W. FRYHOFFER.

The market news service was improved during the year and new activities were added. A growing interest on the part of the trade in market



statistics was evident on every hand, and effort was made to meet trade demands along this particular line in so far as possible. Not only were sources of information watched closely for the purpose of insuring completeness and accuracy, but closer contacts were established. The price reporting service of the bureau is used by many creameries and country shippers in checking market returns, and it is found that there is a growing use of these prices as a basis for actual sales and purchases. Statistics prepared in Washington and at branch offices are now generally accepted and are widely used. With the exception of Boston, the wholesale dairy exchanges in markets where offices of this division are located have discontinued their own statistical organization and are now using as their official statistics those furnished by this bureau. Attention will now be given to making these statistics of greater use to the trade and the industry as a whole through systematic statistical studies, which will result in a better interpretation of market conditions.

#### NEW STORAGE REPORTS

Following requests made by the National Poultry, Butter, and Egg Association, and others, reporting of the daily and weekly cold-storage movement of butter, cheese, eggs, and dressed poultry in an additional number of cities was successfully undertaken during the year. The daily report now includes 10 important markets and in addition a weekly report includes 17 other cities. Daily releases which indicate cold-storage holdings on hand the morning of the current day, and weekly releases each Monday, which report holdings as of Saturday morning, are issued at branch offices of the division. The weekly report is particularly valuable in that it affords frequent information as to stocks in plants containing from 60 to 75 per cent of the total storage holdings of dairy and poultry products in the United States, thus making the report indicative of the total storage movement.

#### LIVE POULTRY REPORTS

Arrangements were made during the year to secure daily reports of arrivals of live poultry at New York City by freight and express and also a report of cars on track each morning, old arrivals and new arrivals being reported separately. This work was undertaken on request from the New

York poultry trade for more complete information. New York City is the largest and most important market in the United States for live poultry, depending largely for its supply upon the Middle Western and Southern States. The necessity for handling live poultry promptly makes complete and accurate information an essential to both shippers and receivers. This information helps also to prevent unwarranted price fluctuations.

#### TURKEY MARKET REPORTS

During the period from the middle of November until the close of the Christmas holidays a turkey market report was issued from the eastern branch offices and from Washington. This report contained information regarding supply, demand, and prices at distributing markets and at the principal turkey-shipping points in Texas. The turkey crop in Texas constitutes one of the principal sources of supply for eastern markets, and this shipping-point information was recognized as being of particular value by wholesale dealers and others in the city markets. Prompt information from the markets resulted also in a better understanding on the part of the shippers in the country.

#### PERMANENT BRANCH OFFICES

Permanent offices of the division are located at New York City, Chicago, Philadelphia, Boston, Fond du Lac, (Wis.), Minneapolis, and San Francisco. These are all reporting offices except Minneapolis, which is devoted chiefly to serving mailing lists in the important dairy sections of Minnesota and neighboring States. The extension of leased-wire service to San Francisco during the year placed the San Francisco office in closer daily communication with eastern markets. With the continued development of the Pacific coast as an important source of supply for butter and eggs, interchange of this information contributes to the needs of the trade in the East as well as on the Pacific coast.

#### ADDITIONAL SERVICE REQUESTED

Requests were received for the establishment of new reporting offices at Baltimore and Los Angeles, and plans were developed for partially meeting the need for information at these points. These plans contemplate the establishment of statistical services to report on supplies reaching these markets. The Baltimore Butter



and Egg Exchange and the State Department of Agriculture in California have cooperated in working out an arrangement which it is expected will be satisfactory until a more extensive program to meet the full needs of the local markets can be provided. The Pacific States Butter, Egg, Cheese, and Poultry Association has indicated a desire for the establishment of offices at Portland, Oreg., and Seattle, Wash.

Numerous requests for price reports on eggs and poultry continued to reach the bureau during the year, but the existing branch office organization could not handle such work. It seemed inadvisable also to undertake reporting prices until uniform grades had been established. Work in connection with the tentative United States egg grades points to the adoption of uniform grades, and when this is accomplished the reporting of egg prices can be undertaken on a satisfactory basis.

#### BUTTER-INSPECTION SERVICE

The outstanding development in the butter-inspection service during the year was the drawing up of a cooperative agreement with the Philadelphia Produce Exchange providing for a joint inspection service. Under the agreement the authorized butter inspector of the department became the official inspector for the exchange. Arrangements were made also with Minnesota for a joint Federal-State butter-inspection service. In Minnesota the work will consist almost entirely of inspection of butter concentrated for shipment to distributing markets, while at Philadelphia the inspections are made after arrival.

Butter-inspection service continued to be maintained at the following markets during the year: New York, Chicago, Philadelphia, Boston, San Francisco, and Washington. There was a slight increase in the amount of inspection work done for shippers and receivers, although the largest increase consisted of inspections made for large users of butter such as Government departments, State and city governments, institutions, restaurant companies, steamship lines, etc., which purchase butter on contract specifications.

Changes in personnel and the small force available are partly responsible for such a small increase in the commercial inspections. Resignations made new appointments necessary, and the assignment of both inspection and market-news service work to some men made it impossible for the inspec-

tion service to be satisfactorily handled at all times. The wholesale trade is particularly displeased when changes in inspectors are made, and on each new assignment the inspector must win the confidence of the trade as to his own ability. The reason for this is obvious when it is recognized that the inspection of butter is very largely a matter of personal judgment, depending on the inspector's sense of taste and smell.

#### *Summary of inspections made during the year*

Market	Commercial inspections	Government inspections	Total inspections
New York.....	1,562	442	2,004
Chicago.....	1,569	10	1,579
Philadelphia.....	2,237	360	2,597
Boston.....	447	173	620
San Francisco.....	115	292	407
Washington.....	18	109	127
Total.....	5,948	1,386	7,334

#### DAIRY-PRODUCTS STATISTICS

An important feature of the work of this division is the preparation of the report on production of manufactured dairy products in the United States. The list of manufacturers from whom information is obtained now approximates 10,000 names. Special effort was made during the year to make the report more fully represent the total production of the United States through a more persistent follow up of negligent firms and to push forward the time of releasing the report. Cooperation of various State officials has been secured, and further negotiations are under way which should bring favorable results. From the standpoint of the industry, the desirability of a uniform plan of compiling dairy-products statistics as to periods covered, commodities included, etc., is obvious.

#### TENTATIVE EGG GRADES

The past year witnessed a marked advance in the egg-standardization program. During that time United States grades for eggs were issued in tentative form as a basis for discussion and criticism by all branches of the egg industry. Work was done and is being continued in examining commercial shipments and grades of eggs and in reporting their quality in terms of United States grades. Commercial grades are studied in connection with the United States grades for the pur-

pose of detecting weakness in the Federal grades and in order that any modifications which seem desirable may be made.

Following two conferences with members of this bureau in 1924 representatives of the egg trade put themselves on record as approving the general principle of uniform standards for eggs and agreed to cooperate with the department in the establishment of such standards and grades as would prove satisfactory and practical. A committee representing the different interests in the egg industry is to be appointed by the National Poultry, Butter, and Egg Association to assist the department in putting these grades into final form. It is expected that the committee will meet this fall and that soon thereafter the United States grades will be published in final form. A handbook covering in detail the inspection of eggs has been prepared, but its issuance is being deferred pending the issuance of the Federal standards.

Educational work has been done in acquainting the trade and producers with the proposed egg standards. A representative of this division attended the spring meetings of a number of the State associations of egg shippers in the Middle West, explained the grades, and demonstrated them to the members. In addition assistance was offered the various States through their extension services in promoting a standardization program, and up to July 1 such assistance was rendered in West Virginia, Missouri, Indiana, and Vermont. A large number of other States have requested similar aid, which will be extended them during the present fiscal year.

#### BUYING ON QUALITY BASIS

To secure for producers the full benefit of egg standardization, it is essential that eggs be bought from producers on a quality basis so that producers of eggs of higher grades shall receive a better price than producers of eggs of lower grades. A great deal of effort was directed, therefore, to a campaign to encourage the marketing of eggs on a quality basis. This was carried on through the extension services of the different States and in cooperation with State egg-shipper associations, and with individual buyers and shippers. To further this work four mimeographed circulars were issued in the form of letters addressed to egg producers,

country buyers, carlot shippers, and county agents. Grades also have been issued which are combinations of the United States grades, for use in buying eggs from producers at country points where it may not always be feasible to employ the full range of United States grades. A mimeographed circular was issued which called attention of producers to the points which should be given consideration in order to produce eggs of high quality.

#### EGG-INSPECTION SERVICE

A striking evidence of progress in egg standardization was the inauguration early this summer of an egg-inspection service on the New York and Chicago markets. At New York the time of an egg inspector has been almost entirely occupied in making contract inspections of eggs for the Navy, various shipping lines, Government hospitals, and for a chain of restaurants. In June inspections of this character covered nearly 5,000 cases of eggs. Experimental inspection of commercial grades of eggs in terms of United States grades have also been made by the inspectors as time permitted.

#### COOPERATIVE EGG MARKETING

Assistance was given to the Virginia Poultry Producers' Association in establishing field grading work and in training graders in candling eggs and in the recognition of egg quality. Assistance was given to the Missouri Farmers' Association in handling egg-grading problems by checking up on the work of the candlers and by demonstrating the United States grades for eggs.

During the spring assistance was given the New Jersey bureau of markets in working out grades for eggs and the establishment of a plan whereby eggs candled and graded by an authorized inspector of that bureau could be sold under a State seal which serves as a certificate of the quality of the eggs. Representatives of this division went to New Jersey to assist in training egg inspectors to grade the eggs marketed by the authorized brooders' association of that State.

In addition to these activities the division furnished assistance in Virginia, Alabama, Ohio, Illinois, and Missouri, where cooperative marketing agencies were being organized or where organization was being contemplated.



## COOPERATIVE DAIRY MARKETING

The growing interest of farmers in cooperative marketing as a means of improving marketing conditions and of increasing their net return has been especially manifest among producers of dairy and poultry products. Many calls for assistance of the department have been answered and many groups of farmers have been helped in working out plans of organization, including financing and methods of operation.

The problems of marketing dairy products by producers vary in different sections. Near large cities the problem is primarily one of marketing milk to city distributors, and in some instances of undertaking city distribution through a producers' cooperative milk distributing plant. In butter-producing territory and in cheese-manufacturing districts, where the farmers' milk and cream are manufactured into cheese or butter in cooperative factories, the problem of marketing is largely that of selling the manufactured products through associations or federations of cooperative creameries or cheese factories. On these various problems of marketing dairy products cooperatively, representatives of the department have been able to render much valuable assistance in determining the type of organization best suited to meet the conditions in the various sections.

## NEW PUBLICATIONS ISSUED

During the year definite progress was made in the preparation of publications, and a number of mimeographed circulars as well as bulletins have been prepared. There has also been prepared material on marketing poultry products, which is to appear in the 1924 Yearbook. During the fall a trip was made through the Middle West to secure material needed in the preparation of a bulletin on the construction, operation, and equipment of poultry and egg-packing houses. The work of gathering material for a handbook of poultry statistics has reached virtual completion, and the handbook of dairy statistics has been revised. Gathering of information for the issuance of a bulletin in cooperation with the Bureau of Animal Industry on marketing baby chicks has been nearly completed.

## DIVISION OF FRUITS AND VEGETABLES

WELLS A. SHERMAN, *in Charge*

Market News Service, EDWIN W. STILLWELL; Inspection Service, F. G. ROBB; Grades and Standards, H. W. SAMSON; Standard Containers, H. A. SPILMAN; Research Studies, H. W. SAMSON.

A substantial and much-needed expansion of the market news service was possible during the past year through an increase of appropriation for this work. On July 1, 1923, the leased-wire telegraphic service of the bureau was extended from Kansas City to San Francisco, and on September 1 the wire was extended to Atlanta and Jacksonville. This extension made it possible to open five additional market stations, viz, Atlanta, Denver, Salt Lake City, San Francisco, and Portland. Permanent branch offices are now located in the following cities, all but two of which are connected with Washington by the leased-wire system, these stations being Los Angeles and Portland, which are reached by commercial wires and radio: Atlanta, Ga.; Baltimore, Md.; Boston, Mass.; Chicago, Ill.; Cincinnati, Ohio; Denver, Colo.; Fort Worth, Tex.; Kansas City, Mo.; Los Angeles, Calif.; Minneapolis, Minn.; New York, N. Y.; Philadelphia, Pa.; Pittsburgh, Pa.; Portland, Oreg.; St. Louis, Mo.; Salt Lake City, Utah; San Francisco, Calif. In addition the leased wire reaches the following cities where the service is maintained by State offices: Harrisburg, Pa.; Richmond, Va.; Raleigh, N. C.; Columbus, Ohio; Stevens Point, Wis.; Jefferson, Mo.

Temporary field stations in 36 important producing sections issued reports in season on apples, cabbage, cantaloupes, celery, grapes, lettuce, onions, peaches, pears, plums and prunes, potatoes, strawberries, tomatoes, and watermelons. Leased-wire service reached two of these field stations—Waupaca, Wis., and Sacramento, Calif. New temporary offices were opened during the year at Orlando, Fla., Raleigh, N. C., Mobile, Ala., Grand Forks, N. Dak., Grand Junction, Colo., and Sacramento, Calif. In all the news service had its representatives in 30 different States.

## ADDITIONAL PRODUCTS REPORTED

The daily telegraphic reports of shipments were increased to include 14 additional products, the following



being a complete list, those followed by an asterisk having begun during the past year:

Apples, asparagus,\* cabbage, cantaloupes, casabas, cauliflower, celery, cherries,\* cucumbers,\* eggplant,\* grapefruit,\* grapes, honey dews, lemons\*, lettuce, mixed citrous fruit,\* mixed deciduous fruit, mixed vegetables, onions, oranges,\* peaches, pears, peppers,\* potatoes, plums and prunes,\* romaine,\* Satsumas,\* spinach, strawberries, string beans,\* sweet potatoes, tangerines,\* tomatoes, and watermelons.

Complete reports were issued in season on 20 of these products. Daily-shipment information was released on the other 14 minor products. The monthly mail reports received from local freight and express agents throughout the country include all of the above-mentioned fruits and vegetables and in addition the following commodities: Carrots, cranberries, dried apples, dried peaches, dried prunes, dry beans, rutabagas, and turnips. These mail reports show the car-lot movement from each shipping station.

#### CAR-LOT SHIPMENT REPORTS

The largest number of car-lot shipments ever reported in one year was the record attained last year when approximately 921,000 cars of these various fruits and vegetables were listed. This is a gain of about 55,000 cars over the highest previous record. The total number of mimeographed reports issued at market stations was about 6,068,000 and those published at temporary field offices about 2,516,000, making a grand total of 8,584,000 reports, or an increase of 1,063,000 over the preceding year. Mailing lists at market stations and Washington included 38,735 names and field-station lists totaled 28,835. Distribution of market reports was made also by radio, telephone, and telegraph (collect), and through the press. The weekly bulletins on peanuts continued to be issued from Washington to a mailing list of about 1,000 and the semimonthly market reports on honey and beeswax continued to meet with favor among a large number of beekeepers and dealers in honey. The weekly market review, the weekly summary of carlot shipments, and the monthly market review reached a limited number of persons interested in this type of information, but the data contained are given wide dissemination through the press and by radio. Special telegraphic summaries are furnished collect to a few papers. The daily radiophone reports and the weekly marketgrams were continued

with good effect and much material on fruits and vegetables was published in Crops and Markets.

#### UNLOAD REPORTS

The number of products covered by the unload reports regularly obtained by division representatives in 21 city markets was increased from 10 to 16 by the addition of grapes, grapefruit, lemons, oranges, watermelons, and lettuce. Railroad agents in 14 other cities also supply this information, thus making the unload data cover 16 leading fruits and vegetables in 35 cities. These statistics are becoming more complete and more valuable each year. There has been a great demand for special tabulations of unloads and for the mimeographed sheets or summaries that have been prepared. The information is released in many ways by branch offices, is used in field station summaries, and enters into the preparation of publications of importance in the field of economics. The unload reports not only show the sources of supply in these 35 markets but also indicate the consuming capacity of each city for these particular fruits and vegetables.

#### STATE AND BUREAU COOPERATION

By the extension of the leased-wire system to the capitals or other central points in Virginia, North Carolina, and Florida it was possible to inaugurate cooperative market news work in those sections in addition to the six States already enjoying this arrangement. Cooperative market reports were also issued in Georgia, South Carolina, Michigan, Colorado, Utah, California, and Alabama. State agencies and local growers and shippers assisted financially in the operation of two-thirds of the temporary field stations of the news service. Some of the States, notably New York and Texas, took the initiative in rendering a news service on a cooperative basis so as to give the greatest possible aid to farmers and distributors in their respective territories. New York grapes and lettuce, Texas spinach, cabbage, and other crops were covered in this manner.

#### SHIPPING POINT INSPECTION SERVICE

The shipping point inspection work has almost doubled during the past year, 130,959 cars of fruits and vegetables having been inspected at shipping point during the fiscal year, as compared with 72,466 inspected during the previous year.

The following table shows the number of cooperative shipping-point inspections made in the States listed during the last two years:

State	1923	1924
Alabama		251
Arkansas		88
California	17, 778	46, 424
Colorado	24, 815	10, 341
Delaware		50
Florida	162	8, 370
Georgia	45	1, 392
Idaho	13, 338	18, 403
Illinois		208
Louisiana		266
Maine	384	
Massachusetts	67	7
Mississippi		1, 709
Missouri	36	57
Montana	444	805
Nebraska		4, 830
Nevada		31
New Jersey	1, 499	719
New York	905	1, 475
North Carolina		566
North Dakota	432	
Ohio	78	169
Oregon	387	4, 442
Pennsylvania		274
South Carolina	1, 091	1, 712
South Dakota	308	368
Tennessee	51	232
Texas		6, 349
Utah	651	1, 642
Virginia	4	526
Washington	8, 917	15, 360
West Virginia	39	232
Wisconsin	1, 035	2, 305
Total	72, 466	129, 049
Arizona <sup>1</sup>		300
Indiana <sup>1</sup>		551
Kansas <sup>1</sup>		855
Missouri <sup>1</sup>		204
Grand total	72, 466	130, 959

<sup>1</sup> Straight Federal inspection at shipping points.

Of the total of 130,959 cars inspected at shipping points, 239 reinspections were made at receiving markets and in 110 cases the findings of the original inspector were changed.

This indicates that during the past year one car out of 1,190 was reversed, while during the previous year only one out of 2,131 was reversed. The increase in number of reinspections made and cars reversed is due largely to greater familiarity on the part of the trade with established grades and with the methods of the inspection service. The total number of reinspections has been small considering the total volume of work performed, and the policy followed by the bureau has served to inspire more confidence in the service on the part of receivers.

All reinspections are called to the attention of the supervisor of the district in which the original inspection was made and careful investigation of the work of the inspector follows. In

a number of instances such inspectors have been discharged as a result of such investigations.

The second year of shipping-point inspection service has demonstrated that more progress can be made in securing the adoption of recognized standards at shipping point through inspection service in a single season than can be accomplished in a number of years by any other means. Without exception supervising inspectors have reported marked changes in grading practices in every section where shipping-point inspection service has been used a second season. A constant increase in demand by receivers for inspected products speaks loudly of the benefits being derived by the trade from this service. Insistence by several organizations on the shipment of graded products only, has kept on the farms a considerable volume of low-quality products which otherwise would have gone on the market in competition with the higher quality offered by the better growers and shippers.

Cooperative organizations have been greatly benefited by the inspection service because of the assistance it has rendered them in dealing fairly with their members without the embarrassment usually experienced by officers of these organizations in obtaining deliveries of uniform quality from their members.

The use of the shipping-point inspection service by f. o. b. auctions has not increased as was expected a year ago. One auction company has ceased business on account of inability to secure a sufficient number of cars for sale to justify the enormous expense of maintaining the leased wires between the principal markets in which the auction offers cars for sale. The second auction company has not shown an appreciable increase over last year's work.

#### TERMINAL MARKET INSPECTIONS

Inspectors were maintained in 25 of the principal receiving markets of the country and inspections were made at a total of 323 points. Inspections are made at points which can be conveniently reached from the markets at which inspectors are stationed when the applicant pays the traveling expenses incident to such service.

A total of 29,283 inspections were made at receiving points during the year which is an increase of 1,114 cars over the preceding year. It was found

necessary to decline over 2,000 inspections because of lack of time. The following table shows the number of inspections at receiving points by months:

*Terminal Inspections by Months For Fiscal Year 1924*

	Inspections total	Total carlots	Total Less than carlots	Declined for lack of time	Carrier inspections
July.....	2,194	2,040	154	646	783
August.....	1,388	1,324	64	429	418
September.....	1,548	1,460	88	341	296
October.....	2,899	2,759	140	109	565
November.....	2,370	2,334	206	169	266
December.....	1,788	1,620	168	9	245
January.....	2,750	2,422	328	24	580
February.....	2,795	2,447	348	23	556
March.....	2,687	2,423	264	37	387
April.....	2,737	2,002	735	25	891
May.....	2,804	2,618	186	142	1,181
June.....	3,123	2,915	208	142	1,493
Total.....	29,233	26,394	2,889	2,147	7,661

Total inspections for carriers: 1921-22, 12,105 cars; 1922-23, 8,524 cars; 1923-24, 7,661 cars.

In addition, inspections were made for the Navy, Marine Corps, and Shipping Board amounting to 39,751,625 pounds of produce, as compared with 37,632,581 pounds for the preceding year. In addition, 4,895,003 pounds were inspected for the United States Lines and large quantities for the Munson Line, and for the laid-up fleet. Very substantial savings were effected for the Federal Government by these agencies through rejections of products which were below grade on the basis of the Federal inspection certificate.

#### PROGRESS IN STANDARDIZATION

One of the most important aids to the orderly marketing of farm products is the use of uniform standards. The rapid extension of the shipping-point inspection service has made it necessary to expedite the work of formulating Federal standards, since well understood and acceptable standards are essential to the success of the inspection service. During the year grades were recommended for 12 additional products and for 7 other products the grades were revised. The following is a complete list of the fruits and vegetables for which Federal grades have been formulated, those marked with an asterisk having

been either issued or revised during the last year:

Barreled apples, \*beets, asparagus, cabbage, \*cantaloupes, \*carrots, \*cauliflower, celery, \*citrus fruits, cucumbers, \*table grapes (California), \*juice grapes (California), lettuce, \*Bermuda onions, Northern-grown onions, \*peaches, \*shelled white Spanish peanuts, \*farmers' stock peanuts, \*pears, \*sweet peppers, \*plums and prunes, \*pineapples, potatoes, \*string beans, sweet potatoes, strawberries, \*turnips, \*cannery tomatoes, tomatoes, \*watermelons.

In addition to these standardization studies, extensive investigations have been made with a view to revising grades for celery and northern-grown onions. Careful study has been made also of the grading of canning tomatoes and citrus fruits. The citrus fruit studies were confined to Florida and had particularly in view the more exact definition of terms. One of the outstanding accomplishments of the season in standardization was the use of the United States peach grades in Georgia. These grades were adopted by the Georgia Peach Growers' Exchange and served as a basis for the inspection of more than 10,000 cars. This is the first year that Georgia has used any recognized standard and the services of a standardization specialist were made available in order to bring about uniformity of interpretation by the various supervising inspectors in charge. The use of the United States grades for Bermuda onions was also extended to Texas for the first time since 1915 and the grades as revised were found to be thoroughly practical.

#### REJECTION OF SHIPMENTS

A serious problem in the marketing of fruits and vegetables is the rejection of shipments purchased at point of origin by buyers in distant city markets. A study has been made of the causes of such rejections of shipments of northwestern boxed apples in the receiving markets. This study covered 10,777 carloads shipped from 15 important dealers in the State of Washington. Many shippers contend that rejections of their shipments occur almost invariably during market slumps, and that during such periods receivers refuse their purchases merely to avoid losses, while on the other hand receivers claim that rejections are the result of the failure of the shippers to comply with the terms of sale. Although a study of but one year does not warrant absolute conclusions, it was shown that approxi-



mately 80 per cent of the rejections during this year were on the ground of poor condition, and that the rejections increased as the season advanced and the fruit became ripper. It did not appear that there is any definite relation between the number of rejections and the trend of f. o. b. prices. It was shown clearly that a large number of rejections might be avoided by making the terms of sale more definite and specific; and if shippers took the trouble to secure legal confirmation of sales, redress could be secured by them more often. It has been clearly demonstrated that the practice of buying on a Government shipping-point inspection certificate is of great advantage to both parties, as this certificate states definitely the variety, grade, size, maturity, and general condition of the fruit as well as the condition of the car and equipment. Thus the buyer is informed as to exactly what type of shipment he will receive, and little chance is left for misunderstanding at time of delivery.

At the request of the Federal Farm Loan Board a study was made and a report submitted on the marketing of Maine potatoes. The purpose of this study was to determine the suitability of potato warehouse receipts as collateral for loans.

An interesting study was made and a report prepared on the business methods of the Bolton products stores in Philadelphia. This is a new type of enterprise in the nature of a chain-store system which handles fruits and vegetables only on a self-service basis. This type of enterprise was found to be popular with the public and a financial success.

#### ACTIVITY OF AUCTION COMPANIES

Although auction companies have been in existence for a long period, the first comprehensive report covering their functions and methods has just been completed. It was found that auction companies, while handling a large number of commodities, were concerned chiefly with fruits, both citrus and deciduous. The business of the auction companies in handling well-standardized products has grown rapidly. This increase may be largely attributed to the patronage of large cooperative as well as large private marketing agencies, who find in the auction a quick method of disposing of their produce for a cash return.

#### RESEARCH WORK PUBLICITY

A number of other very important studies have been carried on during the year, including an analysis of the distribution of citrus fruits from both California and Florida; a compilation of shipments by commodities and States; unloads of specific commodities in large receiving markets; and carlot shipments of fruits and vegetables by commodities and shipping point. A number of bulletins have been prepared and wide publicity has been given to this information through press releases and the department's publications. The type of research work is being stressed at the present time which will give practical assistance to producers and marketing agencies in avoiding the heavy losses which have been attendant upon the fruit and vegetable trade through faulty methods of handling and shipping, and through the shipping of ungraded stocks which are not marketable and which entail heavy freight charges as well as losses from the cost of handling.

#### STANDARD CONTAINERS

Manufacturers of containers are manifesting an increased tendency to submit samples of their output to the bureau for testing in order to secure compliance with the law and to seek the advice of this bureau with regard to specifications for containers which they intend to manufacture. The work of testing containers has steadily increased. During the fiscal year 4,546 samples were tested as compared with 3,613 in 1923. The proportion of samples which meet the specifications of the bureau has also increased materially. A representative of this bureau visited 53 container factories in 12 States in the course of a year and made addresses at the conventions of the National Basket and Fruit Package Manufacturers' Association as well as at meetings of a number of similar organizations. The program of this bureau was indorsed by a number of bureaus and horticultural societies. In addition to enforcing the provisions of the standard container act a great deal of work has been done in connection with standards which have not yet been fixed by law.

#### COLLECTION AND DISTRIBUTION 1918 EXCESS-WOOL PROFITS

WELLS A. SHERMAN, *In Charge*; W. L. EVANS, *Assistant*

Wool growers have thus far received refunds aggregating \$444,574.93 from

the excess profits collected by this department from dealers who handled the 1918 wool clip under the Government regulations which fixed the price of wool and limited the profits which might be made. This work of collecting and distributing excess wool profits was transferred from the War Industries Board to the Department of Agriculture by Executive order dated December 31, 1918. Since that time Congress has made annual appropriations to complete this work. Incidentally, this effort to keep faith with the growers is proving profitable to the Government, for offsetting the \$143,595 expended since December 31, 1918, from appropriations made by Congress, it is already known that \$200,000 of the money collected will remain undistributable through the impossibility of locating the growers, making a net gain to the Government up to this time of nearly \$100,000.

Total excess profits of \$1,484,207.99 were found to have been made on the 1918 season's wool operations. Of this amount \$748,829.22 has been collected, the balance of practically an equivalent amount being due from only 58 dealers. Many of these dealers are resisting payment, making suits in Federal courts necessary. Ninety per cent of the \$750,000 awaiting collection is payable by 12 dealers. The efforts of this department are directed particularly at this time toward expediting and assisting in the trials of pending cases. All cases thus far reached for argument or for trial have been decided in favor of the Government.

#### ADMINISTRATION OF THE UNITED STATE WAREHOUSE ACT

H. S. YOHE, *In Charge*

Grain Warehousing, H. K. HOLMAN, JR.; Wool Warehousing, C. NAGEL; Tobacco Warehousing and Standardization, F. B. WILKINSON; Fruit and Vegetable Warehousing, PAUL M. WILLIAMS; Cotton and Broom-corn Warehousing, under direct supervision of division leader.

Prior to February 23, 1923, the warehouse act was confined to cotton, grain, wool, and tobacco. On that date the act was amended so as to give the Secretary of Agriculture authority to place any agricultural product which he considered properly warehouseable under the provisions of the law. In the past year investigations preliminary to drafting regulations for the storage of peanuts, potatoes, broom corn, beans, nuts, hay, dried and canned fruits, apples, and cane sirup were undertaken. Regulations for the

storage of peanuts were promulgated on September 29, 1923; for the storage of the late crop of potatoes on May 10, 1924; and for broom corn on May 16, 1924. Regulations for the storage of dry edible beans have been drafted and will be submitted for promulgation in time to take care of the coming season's crop.

#### LICENSED WAREHOUSE RECEIPTS

One of the main purposes of the warehouse act is to furnish a form of warehouse receipt which will be of distinct aid to the grower in the orderly marketing of his crops. Such a receipt must be acceptable to the bankers generally for loan purposes. Eleven of the thirteen cotton growers' associations which are functioning on a state-wide basis are now using the Federal warehouse receipt for financing purposes. Individual growers who are not members of the associations are also using it. That it is serving them is evidenced by a report submitted by a planter to this department indicating that some time ago he took about 1,200 warehouse receipts to a bank to secure a loan. The banker accepted all the receipts which were issued by federally licensed warehouses, but refused to lend on those issued by nonlicensed warehouses.

Many letters and reports are received from farmers, bankers, and others which clearly indicate that the warehouse act has been of real service. From the northwestern grain-growing section a letter was received recently which reads in part as follows:

You no doubt are aware that there have been quite a number of bank failures in the Northwest this year and this would naturally cause a drain on the more solid banks, but at that we experienced absolutely no trouble in financing our collateral and we are satisfied that this was due to the fact that our warehouses were all bonded under the Federal warehouse act and the grain storage was under the supervision of your department.

The rice growers' cooperative associations of Louisiana, Arkansas, and California all store their rice in federally licensed warehouses in order that they may arrange to secure funds necessary to finance their operation by use of the Federal warehouse receipts.

A great many bankers have indicated in no uncertain terms their approval of the Federal warehouse receipt. This receipt is making for larger loans on agricultural products and at the same time at lower rates of interest. The Washington State Bankers' Association at its annual

meeting last June adopted a resolution strongly indorsing the Federal warehouse act.

The action taken by the board of directors of the Federal Reserve Bank of St. Louis as a result of the cooperation between that bank and this department will have a far-reaching influence. A resolution adopted by that board reads as follows:

*Resolved*, That after September 1, 1924, the Federal Reserve Bank of St. Louis and its branches will not accept as collateral warehouse receipts for agricultural products as covered under the United States warehouse act unless such receipts are issued by a warehouse duly licensed under that act.

Because of the fraudulent issuance of receipts in the past by warehouses which were not operated under the Federal law, arrangements were made during the past year for throwing greater safeguards about the issuance of warehouse receipts. The department has arranged with a company which manufactures safety paper to manufacture a special paper bearing a special design which will be issued only to those printers designated by the department for printing warehouse receipts. The designated printers have entered into a contract with the department which will result in giving the warehousemen receipts of superior quality at a lower cost, and which will make it almost impossible for anyone to issue fraudulent receipts. Under this plan the warehousemen place their orders for receipts through designated department representatives who maintain a register of all receipts ordered and who in turn place the orders with the designated printers. Before these receipts are sent to the warehousemen they are carefully checked by department representatives to see that the receipts coincide with the register. They are then sealed by department representatives. When inspections are made of warehouses it is incumbent upon the warehouseman to produce either the receipts which were sent him or, in their absence, to produce copies of the receipts showing that the originals were issued in due form and then produce the commodity in the warehouse which is supposed to be covered by the receipts, or the original receipt properly canceled. This gives the department a complete check on all receipts which the warehouseman is authorized to use. It is the biggest step which has been taken in warehousing to protect the interests of the warehouseman, the depositor, and the banker who may make loans on the warehouse receipt. The plan has been

accepted by all cotton warehousemen who are now licensed and will be put into operation in connection with the new products to which the act is extended during the coming year.

#### BRANCH OFFICES

During the past year the division maintained branch offices at Raleigh, N. C., Atlanta, Ga., Dallas, Tex., Kansas City, Mo., Portland, Oreg., and substations at New Orleans, La., Spokane and Walla Walla, Wash.

#### DIVISION OF COST OF MARKETING

A. V. SWARTHOUT, *In Charge*

This division is concerned chiefly with studies of the spread between the price which the producer of agricultural products receives and that which is paid by the consumer for these products. The total spread between producers' and consumers' prices is roughly known for a number of the more important agricultural products. The portion absorbed by each step in the marketing process is relatively little known, however, and much of the discussion which has been carried by the press has been founded on information not wholly accurate, because reliable and complete data have been available in but few cases. Effort is directed through this division and through the other divisions of the bureau to furnish information which will lead to the reduction of this spread.

The first move in the case of any particular product is to ascertain as accurately as possible what portion of the retail price accrues to each agency in the marketing chain, and, what is fully as important, to understand exactly what services are furnished in return for this portion. This has been done for several commodities, among them bread, milk, potatoes, and apples. In the study of these services and margins data have been uncovered which tend to explain some conditions which without explanation appear to be unjust. An illustration of this is the fact that flour as part of the cost of making bread is becoming less important and is being overshadowed by the cost of labor, of the operation of machinery, and, to some extent, of ingredients other than flour which the baker uses. Due largely to changes in the formula, the cost of these other ingredients has approximately doubled since 1913, while bakery labor has increased about 43



per cent during the same time; hence, since these other costs are relatively larger than the cost of flour in commercial bread making, changes in the price of bread could hardly be expected to follow closely the changes in the price of flour or wheat. The service cost of the preparation and distribution of food products has become such an important item that it far outweighs commodity values, and the consumer's price is influenced much more by fluctuations in these service costs than by fluctuation in farm value of the commodities.

Having ascertained the portion of the consumer's dollar which accrues to each of the agencies of production and distribution, the next step is to determine what the agency did with its portion, how much was paid for labor, rent, fuel, and other items which enter into the cost of doing business, and how much was left for profit to the owners of the business. Such studies as the department has made along this line point to the fact that the net profit received by owners of business is relatively small when considered as part of the total spread. It rarely runs over 5 per cent of the consumer's price and is generally much less than 5 per cent. The cost of furnishing this service, on the other hand, is a vitally more important part, comprising as it does approximately 95 per cent of the spread. Costs, therefore, are the important point of attack for any study looking toward a more efficient marketing system. These costs are greatly affected by efficiency of methods employed, by economic environment in which the particular business operated, size of business, and adequacy of the facilities.

#### MARKETING OF KANSAS WHEAT

In cooperation with the Kansas Agricultural College a study was made covering the operations of 60 grain elevators in Kansas for the crop year 1921-22. These elevators are located in 10 counties, and their operations are believed to be typical of the methods used in marketing Kansas wheat. A preliminary report has been issued which shows the operating margin and the operating cost per bushel for each of the 60 elevators and the division of these costs between labor and other costs. It was found that the operating margin ranged from a loss of 2.05 cents to a gain of 9 cents per bushel, with an average of 4.1 cents. The operating costs varied from 1.9

to 7.42 cents, with an average of 4.37 cents. Net operating results on grain ranged from an operating loss of 8.47 cents to a profit of 6.67 cents per bushel, with the average showing a loss of 0.27 cent. These extremely wide variations in the costs and margins seem to indicate that there is a wide difference in the efficiency of methods used and in the effect of such other factors as competition, location, etc. This study has been continued and records secured during the current year from 194 elevators. A report is in preparation covering the two years' work.

#### RETAIL MEAT TRADE

In cooperation with the Bureau of Business Research of the Northwestern University, a study has been made of the margins, expenses, and profits of retail meat stores in Chicago, Cleveland, and New York. A report has been issued covering the costs of the various sizes of stores and a discussion of the various cost factors. In addition to this, a series of five lectures has been issued, which should be very helpful to the retail meat trade, as they were given wide publicity. The titles of these lectures are as follows:

How Does Your Store Compare with Others?  
Population: Its Effect upon Your Profits.  
Save in Wages.  
That Question of Turnover.  
Compute Expenses as Percentages of Sales.

#### RETAIL PRICE OF POTATOES

An analysis of the retail price of potatoes grown in Maine, Minnesota, Wisconsin, and Michigan and sold in Boston, Chicago, and Pittsburgh has also been completed. This study covers prices, costs and methods, and conditions under which these potatoes were marketed. In cooperation with Cornell University, studies were made of the costs of marketing potatoes in New York, with especial emphasis on the activities of the country buyer and local cooperative association.

#### PRICE OF MILK IN WASHINGTON

A study has been completed covering an analysis of the retail price of milk sold in Washington, D. C. This study furnishes an analysis of the costs of milk delivered on routes by the distributor, milk sold through groceries and delicatessens, and milk sold through cash-and-carry chain stores.

### RETAIL PRICES OF BREAD

A study has been completed covering an analysis of the retail price of bread in seven cities. This study brings out information covering each step in the marketing process and the services and margins involved. In all of these studies it is the aim to make public detailed information covering the varying conditions and methods in order that the way to further study and needed improvements can be more clearly discerned.

### RETAIL MARGIN STUDIES

Studies of retail margins on certain selected fruits and vegetables have been carried on in New York City, Trenton, and Washington, D. C., during the past year, data in New York being collected in cooperation with the Port of New York Authority, and those in Trenton with the State department of markets. The studies in Trenton and Washington are being continued and the material already collected is being analyzed as the basis for a preliminary report.

A study of retail margins of citrus fruits in 39 cities for a period of 10 years was inaugurated during the year and will be finished during this year. The prices on which this study is based were collected by the California Fruit Exchange as part of its regular work and have been loaned to the bureau by that organization.

### TRUCKING COSTS IN NEW YORK CITY

A study of costs of trucking fruits and vegetables in New York City was conducted and a manuscript for a report has been prepared and will be issued within a short time. The study was carried on in cooperation with the Port of New York Authority and has developed some exceedingly interesting facts as to the wastefulness and inadequacy of present trucking methods.

### ADMINISTRATION OF CENTER MARKET

C. W. KITCHEN, *Superintendent*

Administration, C. H. WALLEIGH; Mechanical Section, S. R. MULLEN; Cold Storage, W. J. CAPNER; Inspection, L. A. DELLWIG and G. A. ANTHONY

Litigation between the United States and the Washington Market Co. was concluded during the year. Pursuant to the provision of the act of Congress approved March 4, 1921 (41 Stat. 1441), the appraisal commission

appointed by the President filed its award, after careful deliberation and consideration of voluminous testimony introduced by the experts employed by both sides. The amount fixed was \$960,250, which covered the purchase of the buildings and improvements made at the expense of the Washington Market Co. The value of the land was not included in the award, as title to the land had always vested in the Government. An appeal from the award was immediately noted by the company. This appeal was argued before the district court in December, 1923, and a decision rendered by the court on February 5, 1924, awarding the company a total of \$1,522,197.88, an increase of \$561,947.88 over the amount awarded by the appraisal commission. The act of March 4, 1921, provided that the decision of the district court of appeals should be final, consequently all proceedings covering the transfer of this property to the Government have been concluded.

### MARKET RESEARCH WORK

The collection of wholesale and retail prices weekly for the Cost of Marketing Division was continued with intensive study of data secured from eight meat dealers and from a like number of dealers in other products. All stand holders were required to submit a financial report of business done during the calendar year ended December 31, 1923, part of which information was used by the Cost of Marketing Division for marginal studies being conducted by that division. Lack of adequate information with regard to costs is believed to contribute very largely to the hazards of retailing; and it is felt that the keeping of records will be helpful to the dealers, in addition to furnishing useful data to the department. There were also secured reports on retail prices prevailing at several other public markets in Washington for comparison with prices at Center Market.

The total volume of business reported by retail dealers for 1923 is \$9,451,921.81. In addition, business to the amount of approximately \$5,000,000 was done in the wholesale houses. No record was obtainable of the sales made by the 200 farmers using spaces on the south side of the building. The operation of Center Market furnishes the bureau an excellent opportunity to study at first hand the problems confronting retail dealers in agricultural food products.



### REPAIRS AND IMPROVEMENTS

The program of repairs and improvements started during the first year's operation was continued. Some of these changes have added to the value of the plant while others have reduced the annual operating expenses, and some have increased the earning capacity. The first improvement made during the year was the erection of an incinerator at a cost of \$4,500, which permits of immediate disposition of all debris which had previously been hauled away at a cost of approximately \$2,000 per annum. This equipment relieves congestion and has improved sanitary conditions materially. Two wooden coolers in the courtyard were replaced by others of brick construction which are more efficient and have resulted in the elimination of waste in refrigeration. Eight new modern stands and two cold-storage boxes were completed during the year, and concrete and iron stands were erected for the use of farmers occupying spaces on the street. The increased annual revenue which the above-mentioned improvements will produce is approximately \$2,100, and the saving in operation approximately \$2,000. The total cost of repairs during the year was \$22,250, which included many minor repairs in addition to those mentioned.

### SANITARY CONDITIONS IMPROVED

Persistent efforts were made to keep the market and cold storage clean and improvements in sanitation were effected. Rats and other vermin are being destroyed constantly, and for this work assistance was rendered by the Bureau of Biological Survey. This phase of sanitation work requires constant vigilance. The inspection of meat and meat products and equipment used in the sale of food products has proven useful and valuable, both as a protective measure and in maintaining the confidence of the public in the wholesomeness of food sold at Center Market.

### ICE AND REFRIGERATOR SERVICE

The revenue derived from the sale of ice was less than for the previous year due to the adjustment in price downward to meet competition, and to decreased tonnage sold. The revenue derived from public cold-storage space was practically the same as during the preceding year, but incomes from all space refrigerated was somewhat more. This was brought about by

partitioning certain rooms to accommodate more patrons on a rental basis at a gross increase of rental, also by increasing the space under refrigeration.

### MARKET SUPERVISION

The supervision of the market appears to have been satisfactory to all interests. There were no serious violations of the regulations and but few minor infractions during the year. The demand for space in the market continues and only eight stands changed tenants during the period—without loss of rental to the Government. This condition obtains both as to dealers within the market and to the farmers occupying spaces on the outside of the building. The dealers generally have shown a spirit of cooperation in keeping the market clean and attractive. The two inspectors are constantly on the alert for conditions that might be a menace to health. The inspectors also perform educational work in aiding the various space holders in improving the appearance and conduct of their stands.

### DIVISION OF AGRICULTURAL FINANCE

NILS A. OLSEN, *In Charge*

Farm Credit, G. F. CADISCH: Farm Taxation, C. O. BRANNEN, Farm Insurance.

As a result of the agricultural depression there has developed an active demand for specific information in regard to the financial difficulties and losses of farmers. In order to secure authentic information along these lines a number of studies have been made, some of the results of which have been given wide publicity. A survey was made of farm foreclosures in 15 States in the Middle West. This study brought out the fact that about 8½ per cent of farm owners in these States lost their farms, with or without legal proceedings, between the spring of 1920 and March of 1923. In addition another 15 per cent of the owners were in fact insolvent, but retained possession of their farms through the leniency of creditors. On the other hand, about 14½ per cent of the tenants were found to have lost their property and about 20½ per cent were reported to be on the verge of failure. A survey is being made at the present time in an effort to obtain more adequate data as to the present indebtedness of farmers, as well as the increase or decrease of such debt since 1920. Material also is



being compiled which will serve as indices of changes in the financial condition of farmers. This includes data on farmer bankruptcy cases reported to the Department of Justice, bank failures, commercial failures, and other information which will reflect agricultural conditions. This material shows, for example, that an average of 827 farmers yearly went through bankruptcy before the war as compared with an average of 4,578 during each of the last four years. The manner in which depression in agriculture reacts on business is well illustrated in the record of bank failures. During the four pre-war years, 1910-1913, a total of 200 banks failed, whereas the failures during the four years July 1, 1920, to June 30, 1924, numbered 1,960. Data of this kind are being compiled by years and by States to show time and regional changes in conditions.

#### FARMERS' CREDIT PROBLEMS

The increase in farm debt with its heavy carrying charges has emphasized the importance of using credit wisely and obtaining it at a minimum of cost. Several farm-credit studies have been in progress, the purpose of which is to obtain more detailed information in regard to the credit needs of farmers and the degree to which the various credit agencies serve the farmers adequately and economically.

A study was begun in March on general farm-credit conditions in the United States. The object of this project is to ascertain the volume, sources, costs, terms, and purposes of various classes of credit used by farmers in all parts of the United States. Detailed information has been obtained in regard to farm credit advanced by commercial banks with a view to determining the extent to which these institutions function satisfactorily in the interests of agriculture.

Requests from farmers for credit information, particularly in regard to intermediate credit, have been numerous, and every effort has been made to give these inquiries the attention they deserve. A leaflet on Intermediate Credit for the Farmer was prepared to show farmers how credit is obtained through the new system. The credit facilities provided by the Federal Government have been explained in several magazine articles and news releases.

Cooperative relations by this division with the Federal Farm Loan

Board have been maintained and strengthened. Credit problems which this bureau had occasion to refer to the board have been given careful consideration. On the other hand, this bureau has brought to the attention of the board the fact that the department has a fund of data which should prove extremely useful in the administration of the Federal farm loan and intermediate credit systems. In response to requests from the board some time has been spent in bringing together for them material on specific credit problems.

A number of local farm credit surveys have been made in cooperation with several States in the Cotton Belt. The first of these studies was made in North Carolina and the results published as a bulletin of the State Agricultural College of North Carolina. Other surveys which follow the general plan of the North Carolina study are under way in South Carolina, Georgia, and Tennessee. A study is being made in Texas which covers problems of land tenure, land utilization, rural credit, and farm insurance. Among other useful purposes these studies have served already to illustrate the extent to which farmers depend upon merchant credit in Southern States and the unsatisfactory character of this kind of short-term credit. It was found, for example, that the interest rate charged for merchant credit by various agencies in selected areas of North Carolina in 1921 ranged from 12.8 to 34.3 per cent. These investigations point to the conclusion that the farmer who needs credit should obtain it from specialized credit institutions and not from stores, dealers, or factories.

A study is in progress to ascertain the changes which have taken place over a long period of time in the amount, sources, and conditions of farm mortgage loans in Nebraska. A number of preliminary field surveys have been made of the credit conditions surrounding the production and marketing of fruits, vegetables, and livestock in various parts of the country, and material gathered in this connection is being used in commodity bulletins now in preparation.

#### FEDERAL SEED LOANS

Direct loans to farmers by the Federal Government without the intervention of a financing intermediary are now frequently advocated. Since the soundness of this method of advancing credit to farmers has been questioned, the department's experi-

ence with seed loans will afford valuable light on the subject. Special arrangements were made during the year whereby the seed-loan records now held at Grand Forks, N. Dak., were tabulated. This material will be used as the basis for a report on the experience of the Federal Government with direct loans to farmers.

#### FARM TAXATION PROBLEMS

The studies of the division in the field of farm taxation are of relatively recent origin. In general, it is the object of these studies to ascertain the relative burden of taxation on farm real estate as compared with other classes of "taxables," to ascertain the reasons for the inequalities in the taxation of farm land as compared with other taxable property, to analyze the purposes for which taxes are levied and expended, and to determine the bases for tax adjustments according to equitable and established standards of taxation.

The relation of taxes on farm real estate to net cash rent in 1919 for selected farms in 26 States was studied during the year. It is shown that taxes bear down with unequal weight upon farm land in various parts of the country. The percentage of net rent absorbed by taxes on the farms studied ranged from 5.6 per cent in Southampton County, Va., to 65.6 per cent in Chester County, Pa.

A study of the relation between taxes and rent of 109 Indiana farms during the years 1919 to 1923 has also been made. The tax per acre on these farms was found to have advanced from 90 cents in 1919 to \$1.60 in 1922, and declined to \$1.41 in 1923, and the percentage of net rent paid in taxes rose from 12.4 in 1919 to 39.6 in 1923. For comparative purposes similar information has been secured for urban real estate and banking institutions. Only 16.9 per cent of rural taxes paid in Indiana during 1923, according to these investigations, went to the State government. The remainder was levied and spent locally, 45.4 per cent by townships and 37.7 per cent by counties. Of the average farm tax dollar 47.6 cents was levied for the support of education and 27.8 cents for highways. The remaining 24.6 cents was divided between general government costs, benevolence, and miscellaneous expenditures.

During the past year cooperative studies of farm taxation have been conducted in Nebraska, Kansas, Mis-

souri, and Texas. These studies will show for a series of years the amount of taxes paid by farmers, the relation of farm taxes to farm rents, and the distribution of the farmer's "tax dollar."

An article entitled "Principles governing the equitable distribution of highway taxes" has been submitted for publication in the National Tax Conference Bulletin.

#### DIVISION OF AGRICULTURAL COOPERATION

CHRIS L. CHRISTENSEN, *in charge*

Economics of Cooperation, A. W. MCKAY; Statistics of Cooperation, R. H. ELSWORTH; Legal Phases of Cooperation; Accounts and Business Practices of Cooperative Associations.

The work of the Division of Agricultural Cooperation during the fiscal year has been chiefly concerned with two projects, namely, economics of cooperation and statistics and history of cooperation. Considerable attention has also been given to legal questions pertaining to cooperative enterprises.

#### COMPLETION OF COOPERATIVE STUDIES

During the year a study of the California Fruit Growers' Exchange was completed and the results appeared in bulletin form. This study covered the organization of the exchange, the development of the cooperative marketing of citrus fruit since 1893, an analysis of the economic problems that have confronted the exchange in the course of its 30 years of operation, the methods pursued in meeting these problems, and the services which the exchange has rendered the industry.

A second bulletin which was issued shortly after the end of the fiscal year treats in considerable detail the operating methods and operating expenses of the local associations that make up the California Fruit Growers' Exchange. It points out a number of opportunities for savings in the handling and marketing of citrus fruit.

A study of Danish cooperation was completed during the year and the results will be available in bulletin form early in the present year. The economic conditions which led to the extensive organization for cooperative marketing in Denmark, the underlying conditions of rural life and education which have strengthened the cooperative movement, the extension of the movement and its influence on Danish agriculture are presented in detail.



### ORGANIZATION PROBLEMS

A study was begun during the year of the organization problems and marketing practices of the fruit and vegetable associations in the United States. This study covers a large number of fruit and vegetable cooperative marketing organizations, and statistical information covering 1,232 such organizations has been analyzed. The report made will point out the current practices of fruit and vegetable associations, with a discussion of the success which has attended the adoption of these practices and the various economic conditions that have affected them.

A study of the cooperative organizations which have gone out of business since 1913 has been continued and a report is being prepared for publication. The division has records of approximately 1,050 organizations that have ceased to function since 1913. Of the total number it was found that probably not more than 20 per cent can be classed as failures in the accepted definition of this term. Many of them have dissolved without loss to creditors and in many instances without loss to stockholders.

### STATISTICS AND HISTORY

The work of collecting and tabulating statistical information regarding cooperative associations in the United States was continued. A tabulation made near the end of the fiscal year showed that information regarding 10,160 cooperative business organizations was available. These associations are classified according to farm products handled, type of enterprise, and the State and town in which located.

Data relative to the number of members, amount of business handled, number of years active, kinds of articles purchased, form of organization, the payment of stock and patronage dividends, and to practices regarding the use of contracts have been collected and tabulated. Much of this information has been made available through the mimeographed circular, Agricultural Cooperation. The records of thousands of cooperative associations are becoming more nearly complete as new data are collected. This material is of great value as a source library regarding cooperation in the United States.

A complete statistical review of agricultural cooperation in the United States up to June, 1924, has been prepared as a bulletin of the department

and is now in press. This publication contains detailed figures concerning the status of the cooperative movement in 1913, 1915, 1919, 1921, and 1923. There are also included in the statistical material tables showing the growth of about 30 of the larger organizations.

### COOPERATIVE GRAIN ELEVATORS

During the year the division began a study, in cooperation with the North Dakota Agricultural College, of the organization and operation of cooperative grain elevators in North Dakota. This work includes a survey of some 200 farmers' elevators in the State, a portion of which are known to be operating successfully and a portion of which are in financial difficulties.

At the request of a number of growers a survey was made in cooperation with the North Carolina State bureau of markets and Agricultural College of the strawberry producing area of North Carolina. The survey covered methods of handling strawberries locally and the marketing methods of local and terminal markets, with reference to the possibility of organization for cooperative marketing. Definite recommendations will be made to the producers as a result of this study.

A detailed study of the membership problems of the large centralized cooperative associations marketing tobacco has been begun. This study deals with the fundamental problems arising in the relationship of the members to their associations. Present methods of maintaining contacts with members and keeping members informed regarding the activities of the association will be studied. It is hoped that this study will lead to a more complete understanding of these problems and that it will form a basis for a practical program that may be adopted by the cooperative organizations.

A study of the development and present status of the farmer-controlled creamery, based on reports from 1,273 associations and a similar study regarding producer-controlled grain-marketing organizations in the United States, based on data furnished by 3,029 associations, have been made and the results published in mimeographed form. During the year statistical information was made available to other Government agencies, to colleges giving courses in cooperation and marketing, to students preparing theses and books upon various phases of coopera-



tion, State extension officials, editors of farm journals, many special writers upon agricultural subjects, officers of cooperative associations, and others.

#### SERVICE AND EXTENSION ACTIVITIES

Agricultural Cooperation, a mimeographed circular containing current news and legal, economic, and statistical information regarding cooperation in the United States and foreign countries, has been issued regularly throughout the year and has reached a large number of farmers, bankers, economists, experiment-station directors, county agents, and others.

The bureau has maintained close contact with extension directors, State marketing specialists, and other State officials regarding cooperative marketing problems. A number of State extension officials now refer to the bureau many problems arising in connection with the development of cooperative marketing in the States. Contacts with cooperative organizations have also been extended. Due largely to the information furnished them through Agricultural Cooperation many cooperative marketing officials now plan to keep the bureau advised regarding their activities and to consult with its representatives regarding special problems.

The division has issued a number of mimeographed reports during the year dealing with special phases of the cooperative movement. These have included a report regarding cooperation during the present decade, a summary of cases and decisions on legal phases of cooperation, a report regarding the principles and practices of cooperative marketing; another dealing with the strength and weakness of cooperative commodity marketing; and a third with the development and growth of cooperative marketing in the United States. Work was completed during the year on "A selected and annotated reading list in agricultural cooperation." This is an exceptionally valuable bibliography for students of cooperative purchasing, marketing, and credit. A brief review of each work cited is given for the benefit of the reader.

#### DIVISION OF LAND ECONOMICS

L. C. GRAY, *in Charge.*

Land Resources and Utilization, O. E. BAKER; Land Reclamation, Sale, and Settlement, R. P. TEELE; Land Tenure, C. L. STEWART; Land Values, C. R. CHAMBERS; Farm Labor, J. C. FOLSOM.

The work of this division deals with the utilization of the land resources of

the Nation for meeting its agricultural needs. It involves a cataloguing of all land resources, a determination of present and future needs for the products of the land, and the outlining of policies that will tend to bring about desirable adjustments in use. There is very little systematic information on the land resources available for use in agriculture or on the ways in which the land resources of the country are now being used. A great deal of hardship, both to established farmers and to pioneer farmers, has been due to ill-judged and misdirected expansion of agriculture. This division is studying the need for land as related to population increase and the regions in which the best opportunities for expansion exist; also the methods used in selling and promoting the settlement of land with a view to developing the most efficient and economic methods of agricultural expansion.

There is very inadequate information as to changes in farm-land values and the influence of the various factors that affect these values. Effort is being made to measure the forces that determine value as a basis for better methods of appraising land for sale, taxation, or credit. The work of the division is directed toward obtaining a more complete knowledge of how the farm land of the United States is owned and of the relationship of such ownership to the welfare of the farming industry and of persons engaged in agriculture, and toward the better understanding of the relationships of the owners of land to those engaged in farming; in short, the various problems of farm ownership and tenancy and the conditions of employment of hired farm laborers.

Finally, all these studies are directed toward an attempt to formulate and suggest legislative policies both for the Nation and the various States which will create a sound economic and social relationship of the farming industry toward the land.

#### FUTURE LAND REQUIREMENTS

The various problems of land utilization often involve the coordination of the work of several of the bureaus of the department, especially the Bureaus of Soils, Public Roads, Plant Industry, Animal Industry, and the Forest Service. This is effected through the committee on land utilization, of which the leader of the Division of Land Economics is chairman. The committee has made a report to the Secretary on the subject of the future land requirements of the

United States in relation to the available supply of land, which was published in brief form in the 1923 Yearbook. Plans are being made for a detailed study of the utilization of the land resources of cut-over sections in the South Atlantic and Gulf Coastal Plains.

#### LAND UTILIZATION DATA

Undoubtedly the most important accomplishment of the year was the work done by the division in connection with the 1923 Yearbook. Two of the articles, one on the utilization of our land for crops, pasture, and forest, and one on farm ownership and tenancy, and a large part of a third on our forage resources were prepared in this division. All the articles in the Yearbook were statistically checked in this division and more or less supplemented, and the entire Yearbook was prepared under the editorial supervision of one of the economists of this division. In addition to the Yearbook articles, 15 bulletins and a large number of mimeographed releases, press releases, and public addresses were prepared by members of the staff in an effort to make quickly available the results of the work of the division.

#### LAND SETTLEMENT AND RECLAMATION

An outstanding accomplishment of this year was the completion of an extensive survey of methods of land settlement in the Great Lakes States. This report analyzes in great detail the practices of the various types of land-settlement agencies operating in that region and the relationship of their practices to the progress and welfare of the settlers.

A study dealing in a broad way with the economic results of our reclamation policy has been completed. A detailed study in the form of a field survey was completed during the past summer in Texas and New Mexico, in cooperation with the Bureau of Public Roads. Several hundred reports were obtained from settlers on five different reclamation projects. A member of this division also acted as chairman of the departmental committee assigned to investigate and report upon the economic feasibility of a proposed irrigation project, at the request of the Secretary of the Interior. A comprehensive survey of the machinery and methods employed by the various States in the encouragement and regulation of land settlement was made and the results of this study are nearly ready for publication.

#### LAND RESOURCES

A study was made of the general land resources of the United States in their relation to the needs for land. This work was introductory to annual studies on the trend of land utilization and to more detailed regional studies. The first of these regional studies is devoted to the North and Central Great Plains and has been under way for several years. It involves cooperative work with the Department of the Interior and the cooperation of a number of other bureaus of the Department of Agriculture, but the work of coordinating and supervising the entire project is in charge of this division. This project includes the study of the agricultural geography of the region, the land tenure and the economic aspects of land utilization and settlement. In this connection, field surveys were carried on by this division during the past summer in eastern Colorado and western Kansas, in cooperation with the State experiment stations.

During the past two years the division has been cooperating with the Bureau of the Census in the tabulation of the six questions on uses of land in the 1920 census. This material has been of great value in connection with other studies of land utilization, and when taken in connection with the forthcoming data from the agricultural census of 1925, will afford a significant basis for determining the recent trend in land utilization.

#### LAND VALUATION

The studies of farm-land values determine by statistical methods the influence of various factors on land values. Significant relationships of income to values have been established. Another important phase of these studies has been a series of surveys in Indiana and Iowa, in cooperation with the Bureau of Public Roads and the Iowa Experiment Station, to determine the influence of various local factors on farm-land values, particularly type of road. Preliminary results indicate strongly that above a given point the value of farm real estate does not increase in proportion to the expenditure for improvement on roads adjacent to the property. If this conclusion is confirmed by further surveys it will introduce a basis for extensive readjustment of policies for financing road building. Special attention is being given to work on the relation of the trend of farm-land values to economic cycles and to studying the rela-



tion of income to capital value in the least developed cut-over portions of the timbered section of the country.

#### FARM OWNERSHIP AND TENANCY

The article on Farm Ownership and Tenancy, contributed to the 1923 Year-book, is a brief summary of some of the results from the research work of this division covering several years, and a graphic presentation of some of the significant facts revealed by the census of 1920. A study has been made of the records of a large corporate estate, which shows the relationship of farm-land values to various other economic factors over a period of several decades. Among other things, the study showed that the influence of price of a product was greater than the influence of yield in determining the variations in rents and values of farm real estate. For the past two years a comprehensive questionnaire has been issued to crop correspondents to ascertain the trend with respect to farm ownership and tenancy and the changes of occupancy. An extensive study of various conditions, determining the financial and tenure progress of farmers, has been nearly completed. Another extensive study of the ownership of land, based on special tabulations from 200,000 census schedules and 25,000 replies to a questionnaire, has been made. A statistical correlation of form of tenure with size of farm, farm-land value, and color of the occupant, with a view to giving a more precise statement of conclusions, heretofore based largely on inference, has been nearly completed. A special study has been made also of part owners as a class of farm operators. A study has been carried on involving the correlation of the standards of living with various phases and conditions of economic progress of farmers. A study of the economic status of negro tenants and owner farmers has been carried on in Virginia and Kansas.

#### STUDIES OF FARM LABOR

The farm laborer occupies a definite position in the so-called tenure and financial ladder, and his position represents a stage in the economic progress of farmers. Special studies of the conditions of supply and demand of farm labor have been made during the past year. Two of these are based on surveys of conditions in the wheat belt, while two are studies of trucking areas in Massachusetts and New Jersey. A survey is being made also of

conditions and machinery of employment in all the North Atlantic States.

#### STATISTICS ON LAND ECONOMICS

For some time the need has been felt for more comprehensive annual statistics on various important aspects of land economics. In connection with the Division of Crop Estimates, arrangements have been made for the establishment of a list of 60,000 correspondents. The division will send inquiries to these correspondents four times each year, involving (1) land values and turnover; (2) land tenure and occupancy; (3) land utilization; and (4) farm-labor conditions. Arrangements are being made also for a special list of real estate men to serve as correspondents. In this project the division has the sympathetic support of the National Association of Real Estate Boards.

#### DIVISION OF STATISTICAL AND HISTORICAL RESEARCH

O. C. STINE, *In Charge*

Foreign Competition and Demand, L. G. MICHAEL; Marketing Statistics, LOUIS H. BEAN and LEWIS B. FLOHR; Production Statistics, PERRY ELLIOTT; Transportation, J. G. CROSS; Agricultural History, DONALD JACKSON; Graphics, G. C. HAAS; Consulting Statistician, G. B. L. ARNER

The principal activities of this division during the past year have been the collection and the dissemination of information relating to foreign competition and demand; the development of bases for determining trends of production, measuring demands for agricultural products, and forecasting prices; the accumulation of historical records; and the standardization of graphic and statistical work.

#### FOREIGN COMPETITION AND DEMAND

The collection and dissemination of information on foreign competition and demand has increased greatly during the past year and with the beginning of the current fiscal year a reorganization of the work is being made which will place an additional number of able economists and statisticians in the foreign field. Additional offices are being established in Europe to keep in closer touch with developments both favorable and unfavorable from the standpoint of American agriculture and to furnish analyses and interpretations of the European situation with regard to production of and demand for agricultural products.



Contacts will be maintained also with agencies purchasing American farm products and educational work will be done in acquainting European buyers with American standards for farm products and in acquainting American producers in turn with the needs of the European trade.

#### FOREIGN OFFICES MAINTAINED

The London office has kept the department in close touch with conditions of the market for agricultural products in the British Isles and has served also as a contact point for collecting information relative to fruit production in the Mediterranean Basin. Arrangements have been made for reports at regular intervals on almonds, citrus fruits, and prunes from the important producing areas.

On account of unsettled and rapidly changing conditions in Germany the Berlin office has been a very important post during the past year. Through this office the department has been kept informed about production and markets for agricultural products in Germany and conditions affecting the markets. Efforts have been made to establish direct contacts between American producers and German buyers and to stimulate demands for our agricultural products. Films showing the production and inspection of meats in the United States have been shown in many moving-picture theaters in Germany. German importers have been supplied lists of American exporters of pork, pork products, grain, and flour. A weekly report has been made upon conditions and tendencies of the Hamburg grain market. In an effort to expand our market for wheat and flour in Germany bankers and importers were interviewed and steps were taken in working out plans for financing imports.

The collection and dissemination of information has increased greatly during the year. The use of radio and cable by the International Institute of Agriculture has increased the value of the information received from that source. The International Institute receives reports by cable from 26 countries, and these reports are promptly cabled to the United States. Through this service important reports are received in the United States soon after they are given to the public in the country to which they relate and are made available promptly to the producers in the United States.

The representatives of the bureau in foreign countries keep the department fully informed of crop and market conditions in the countries to which they are assigned and provide accurate and detailed reports on important developments affecting markets and the supply of agricultural products to be sold in competition with products from the United States. This work is being carried on from London, Berlin, Rome, Budapest, and Buenos Aires.

The cooperation of the State Department in placing the consular officers at the service of the Department of Agriculture makes possible the collection of much detailed information. There are 350 consular offices scattered throughout the world and questionnaires have been prepared and submitted to the consuls in countries or at points from which information is desired on wool, broom-corn, onions, rye, dairy products, cotton, wheat, hemp, and peanuts. In cases of emergency reports are secured by cable or radio. A large number of special reports written by the consuls are sent through the State Department to the Department of Agriculture, and these reports contain much valuable information on crop and market conditions in all parts of the world.

The information collected from the International Institute, consular offices, and the representatives of the department is all collated, organized, and used in furnishing timely crop and market information, and also for analytical studies of the foreign agricultural situation and trends of production and consumption. The number of reports handled has increased during the past year from approximately 10,000 to 13,000, while the circulation of each report has almost doubled.

#### FOREIGN PRODUCTION RECORDS

Records have been kept of the production in foreign countries of all major crops and classes of livestock. Promptly as current reports are received, especially by cable or radio, statements are prepared for the press and telegraphed to interested persons. Each current report is carefully studied and compared with previous reports for interpretation and a statement is prepared indicating its significance in relation to the market for our agricultural products. Records are being built up which provide the basis

for interpreting current information. War changes in boundaries make it necessary to study carefully the statistics of many European countries for the purpose of making comparison between pre-war and post-war production. The task of working out these comparisons is almost completed.

#### AGRICULTURAL TRADE STATISTICS

Statistics of international trade in agricultural products are collected, tabulated, and analyzed. Many statistical tables are prepared for publication in department publications and in the Yearbook. An index number showing the movement in the volume of agricultural products has been prepared.

An analysis has been made of the factors affecting demand for American pork products. A large amount of statistical material has been collected on prices and production of hogs in foreign countries and plans have been made for regular reports of the most important facts and the prompt dissemination of the information in this country. Much material also has been collected relative to the international trade in dairy products, and arrangements have been made for securing regular reports on the prices and the supply of dairy products in some of the principal European markets.

Information as to ocean-freight rates, tariffs, and other restrictions upon the imports of agricultural products by foreign countries is being collected and studied in relation to the market for agricultural products. Special attention has been given to conditions affecting the demand for agricultural products in foreign markets. Data as to employment and wages are being collected because of the relation of consumers' buying power to demand. Special studies have been made of Germany and the United Kingdom as a market for agricultural products.

#### WORLD SURVEY OF AGRICULTURE

The surveys of the agriculture of France, Denmark, Germany, and Poland begun last year have been completed and reports of these surveys are being prepared for publication. A survey was made also of the almond production in the Mediterranean Basin, covering the costs and methods of producing almonds, as well as methods of marketing and prices obtained by the producers. Reports on the agriculture of Chile, Peru, and Argentina have been completed and material is being

prepared for publication as a basis for interpreting foreign information in the countries surveyed. A survey has been made also of the agriculture of Spain and the report is practically ready for publication.

#### GRAPHIC PRESENTATION

Owing to an urgent demand from the various divisions of this bureau, from other Government departments, and elsewhere, a publication is being prepared covering the principles and methods of good graphic presentation. The aim is to secure the use of standard forms of graphic presentation. It is hoped that what has been accomplished in the way of standardization and use of better methods will add greatly to the usefulness of the future publications of the bureau. The progress in the standardization of graphic presentation may be noted in the statistical tables of the department Yearbook.

#### FORECASTING PRICES

A study of unusual interest is the development of bases for forecasting prices through statistical analyses. A special study of the price of oats has been made during the year for the purpose of working out a basis for forecasting oat prices. In this study statistical methods were used to determine the factors affecting the price of oats and in so far as possible to measure the strength of the various factors. This study has made a substantial contribution to this end, but much remains to be done. A large amount of experimental work has been done in measuring the factors affecting prices of corn and hogs. Methods have been developed by which fairly accurate forecasts of the prices of hogs can be made several months in advance. Work will be continued in an effort to develop entirely satisfactory bases for forecasting prices.

#### DIVISION OF FARM POPULATION AND RURAL LIFE

C. J. GALPIN, *in Charge*

Rural Population Statistics, V. B. LARSON; Popular Aspects of Rural Community Buildings, W. C. NASON; Farmers' Standard of Living, E. L. KIRKPATRICK.

Largely through the efforts of this department, "farm population," a definite term which includes those persons who are actually living on farms, is being substituted for the old loose term of "rural population," which included many persons living in small villages and suburbs of cities. The



Bureau of the Census has included six questions pertaining to farms in the 1925 agricultural census schedules which will yield very definite statistics with regard to actual farm population. It has been recognized by leading economists, as well as by the press and various agencies, that authentic statistics on farm population and movements and trends of farm population are necessary to an understanding of general economic conditions.

#### CHANGES IN FARM POPULATION

The currents of movement to and from farms are beginning to receive the attention which this highly important subject merits. Leading economists have begun to look upon this movement as an excellent index of the state of the economic health of agriculture. While farm owners are often slow to shift their occupation on account of economic pressure, the farm laborer class responds quickly, and when methods have been worked out whereby accurate current statistics can be secured with regard to the movement to and from the farm an index will be secured which will respond promptly to changes in condition of prosperity in agriculture. This division is perfecting its methods of studying these movements and it may be possible in the near future to give out annual or semiannual figures on the movements to and from the farm.

#### FARMERS' STANDARD OF LIVING

The first study on the farmer's standard of living, put out in January, 1924, met with instant appreciation. The number of research projects in a wide spread of States, the inquiries from the press, as well as discussions in various conferences, all testify to the basic character of this study. It is particularly interesting to note that discussions have arisen on "How the farm community can raise its general standard of living without more money to spend"; and on a still more interesting topic, "How far is raising the farmer's standard of living a solution to the farmer's economic problem"? The economic significance of the standard of living studies apparently is just reaching the point where a statement of principles can be made. It is believed that a thorough understanding of the problems involved is fundamental to the relief of distress among the rural population, whether this relief is to come through indi-

vidual effort, through farmers' organizations, or through legislation.

#### RELIEF OF TAXATION

Closely connected with standard of living studies is the question of farm taxation. Measures must be taken to relieve the farmers from the severe burden of taxation, and it is believed that much of this burden could be lifted by wiser and more effective expenditure of funds in the immediate locality. A general movement for a consolidation of schools and rural churches is already under way in many localities, as well as the formation of cooperative enterprises of many types which provide services for a community at less cost than they could be obtained by individual effort.

It has been pointed out that the farm population rears and educates a much greater number of children than a corresponding city population, and that there is a constant movement of young people toward the city. This is a subject which might well receive attention in formulating taxation policies. This field of research is very new and the problems involved are great, consequently the major part of the attention of this division is given to procuring reliable statistical data and to assisting the various State and other agencies in planning effective programs covering local country life problems.

#### INTEREST IN COLLEGE RESEARCH

There has been a marked increase during the year in the number of colleges of agriculture and other higher institutions asking for cooperative research problems with this bureau. Ten States began such studies during the year, none of which had done work of this type before. The directors of experiment stations have placed the human rural studies on their lists of legitimate projects. Without question, this admission of rural social studies into the ranks of science has been largely due to the establishment of a basic concept, "farm population," which permits of investigation on a scientific basis.

#### ECONOMIC LIBRARY

MARY G. LACY, *Librarian*

The work of the library has grown steadily in usefulness. The task of combining the libraries of the three bureaus which were consolidated to



form the Bureau of Agricultural Economics has been completed, and the large volume of routine work has been placed on an efficient basis. In addition to handling the requests for books, numbering approximately 16,000 during the past year, 1,874 periodicals are received regularly and circulated throughout the bureau. In addition to the marked increase in the use of the library by the members of the bureau, there has been noted a decided increase in its use by other bureaus and officers of the Government and by outside agencies.

The demand upon this library for bibliographical and reference work is particularly heavy, as it is invaluable to the research work of the bureau to have ready access to the literature of whatever field may be under investigation. In addition to preparing digests and annotated reading lists for the workers of the bureau, many requests for information are received from the public which are cared for by the staff of the library. The most important single bibliography compiled and issued during the year is entitled "Marketing of agricultural products" and consists of 133 mimeographed pages of annotated references. This bibliography was designed to include references to methods of marketing and discussions of the principles upon which methods of marketing should be based.

### DIVISION OF INFORMATION

J. CLYDE MARQUIS, *in Charge*

Editorial Economist-Statistician, S. W. MENDUM; Editorial, Miss C. B. SHEERMAN, Miss A. P. RHODES; Periodicals, A. B. GENUNG, Miss C. M. VIEHMANN, Miss H. L. BONEBRAKE; Press Service, F. GEORGE, Jr.; Radio Market News Service, J. C. GILBERT; Exhibits, B. L. PERKINS; Research in Consumer Demand, L. A. ADAMS.

The product of the bureau's activities in the form of information for distribution in publications, through the press, by radio, and through direct contact with organizations and individuals has steadily increased during the year. While this increased output has been handled without expansion of the staff of the division, the character of the material has been steadily improved.

### PRESS INFORMATION

The widest and most timely distribution of results attained by the bureau is secured through the daily and weekly newspapers and the trade and farm press. To this end approxi-

mately 400 news stories and items of an economic nature, ranging from 600 to 2,000 words each, have been distributed this year. Circulation of the published items reaches into the millions.

Special articles designed for special localities or branches of farm industry have been prepared and distributed and 107 special articles on various phases of the bureau's work have been placed in a large number of widely varying business, professional, banking, and general magazines not agricultural in character, with a view to extending general knowledge of agricultural problems. Requests for such special articles are being received in increasing numbers.

The daily Marketgram has been distributed throughout the year from seven offices on the leased-wire system: Washington, New York, Cincinnati, Chicago, Kansas City, Minneapolis, and Atlanta. Omaha was discontinued during the year and Atlanta was taken on. The Marketgram is prepared in Washington on Mondays, Wednesdays, Thursdays, Fridays, and Saturdays of each week. Each issue covers the week ending on date of issue. This Marketgram is mimeographed in the several offices and mailed at once to daily and weekly newspapers. Through cooperation with the agencies that distribute plate services to newspapers, this weekly summarized market review now reaches over 2,000 weekly newspapers with an aggregate circulation of several millions of readers. A short daily review of market quotations, abstracted from the Marketgram, is supplied to the Daily Digest.

A special report known as the Boston Review is issued from the Boston office for the New England States. This report is prepared on Tuesdays and Fridays and gives a weekly review of the Boston market for fruits and vegetables, dairy products, dressed meats, and the Brighton livestock market. This review is mimeographed and mailed to 102 newspapers.

Weekly review of the grain market is prepared for certain journals with special reference to the localities they cover. This service is described in detail in the report of the Hay, Feed, and Seed Division where the review is prepared.

### RADIO NEWS SERVICE

Radio broadcasting has become an established form of distribution for market reports and agricultural news

after several years of careful experiment.

A survey of the use of radio by farmers' questionnaires was made through county agents, in cooperation with the Extension Service. The use of radio by farmers has been greatly extended during the year. The estimated number of radio receiving sets in use by farmers is over 370,000, compared to 145,000 a year ago.

Broadcasting by radio telegraph from the Navy stations at Washington, Great Lakes, New Orleans, and San Francisco was continued throughout the year, largely to facilitate the operation of field and market stations of the bureau not located on the leased-wire system.

Arrangements for broadcasting from a number of new privately owned radiophone stations have been made, especially in those sections covered by the extension of the leased-wire system. The need for trained market news announcers has been emphasized by the experience of the year. It has also been found that in the majority of instances the most desirable broadcast consists of a brief review of the day's market conditions given at the end of the day when farmers are at their homes. The development of programs from the various stations to meet this demand is being pushed. Special reviews are being prepared in many of the branch offices. Series of general radio talks have been given, and this form of broadcasting will be extended.

#### PROGRESS OF PUBLICATION WORK

The regular publication work of the bureau has progressed along established lines. Six contributions to the new series of statistical bulletions, begun by this bureau last year, have been submitted and three have been issued. Continued effort has been directed toward standardization of practices in statistical and graphic methods. Forty-five regular publications were edited and issued during the year, 30 were edited but are still in press, and 9 were edited but had not been transmitted for publication when the fiscal year closed.

Large distribution items include Crops and Markets, 4,193,000 copies; preliminary reports, 3,550 copies; speeches by chief of bureau and others, 3,350 copies; miscellaneous reports, 4,150.

Twice during the year a list of bureau publications and a list of periodical reports issued by the bureau are compiled. The old lists of publica-

tions of Office of Farm Management and Crop Estimates were revised and issued showing bulletins now exhausted, out of print, or reprinted since the last list was made. Total distribution: List of publications, 2,700; list of periodical reports, 850.

To get results of certain studies and investigations into the hands of those whom they are to benefit as soon as possible and to maintain interest of collaborators in the work, the bureau has developed and followed a plan of issuing preliminary reports in mimeograph form for limited distribution. These preliminary reports have been well received with special indorsement of the promptness with which they make results available. During the fiscal year, 41 such preliminary reports were issued.

Miscellaneous mimeograph work has been systematized during the year, and a considerable saving effected in paper and other costs. Over 4,000 orders were handled during the year. An index is now available, listing preliminary reports, grade specifications, deal reports, investigations, or anything of such nature for which there is likely to be a call. Special distribution of these reports is made as soon as issued.

A new outlet for certain kinds of material from this bureau has been arranged for through the Journal of Agricultural Research. It has been determined to segregate hereafter for publication in that journal analyses and descriptions of research methods and similar lines of work that are of much use to students but not to the great body of readers of agricultural bulletins.

Special publicity campaigns were put on, such as the "Clean your own wheat" campaign in the spring-wheat States. Other campaigns dealt with the standardization of farm products, uses of the market news services of the bureau, better methods of farm management, keeping of farm accounts, and other phases of agricultural economics. The press material issued in these campaigns was widely published.

#### CROPS AND MARKETS

In October plans were started for changing the scheme of publication of the weekly periodical, Weather, Crops, and Markets, to effect savings in the printing bills. These were worked out and put into effect with the beginning of the calendar year, when the name of the periodical was changed to Crops and Markets. The weather



reviews and charts were eliminated and have since been published by the Weather Bureau, and the material was divided into weekly reports of market movements and prices, 16 pages each week; monthly statistics and general reviews with the needs of the crop reporters and of statisticians chiefly in mind, one issue a month, 24 to 40 pages. The mailing lists were divided, about 15,000 to receive the weekly periodical, and 117,500 to receive the monthly supplements. The chief drawback now is the time required to issue the supplements which contain the crop reports.

#### EXTENDING ECONOMIC INFORMATION

Dissemination of economic material in cooperation with extension forces has gone forward according to the program laid down last year. In general, the effort has been to coordinate the bureau's material respecting production, movement, prices, and consumption, and to make it quickly available to key men throughout the country. Charts, brief special reports, and exchange reports from the colleges have been issued from time to time.

The Agricultural Situation, a 20-page multigraphed summary, has been issued promptly on the first day of each month. The circulation of this sheet, which expands only in response to specific, individual requests, has now reached approximately 4,500. Press clippings indicate that it is being increasingly quoted by farm papers.

A condensed 4-page edition of the Agricultural Situation has also been issued during the year over the signature of the Secretary, going to about 9,000 leading farmers who signified a desire to receive it. This edition gains special interest by reason of the fact that the Secretary personally writes and signs the first-page statement each month.

Issuance of regular mimeographed reports has continued. The Bureau of Agricultural Economics News has become an important asset to our branch offices, particularly, as it keeps them in touch with every development and change in the work of the bureau, its administration, its field activities, and its personnel.

The weekly report, State and Federal Marketing Activities, has been indexed since January, and the index is issued quarterly to increase the value of the report to marketing officials, teachers of marketing, and others in-

terested in the development of marketing work. A summary of extension work in marketing as conducted at 17 of the agricultural colleges during the calendar year 1923 has been compiled.

#### EXHIBITS, MOTION PICTURES, AND PHOTOGRAPHY

Demand for exhibits and other illustrative material depicting the work of the bureau continues. The bureau participated in three international exhibits during the year—International Textile Show, Boston, Mass., International Livestock Exposition, Chicago, and the International Dairy Congress exhibit at Syracuse, N. Y. Exhibits were made at many smaller shows and State fairs, including the Washington Radio Exposition. In the latter case the exhibit was afterwards loaned to the management of that exposition for use in other cities. A special cotton exhibit, accompanied by a cotton specialist as lecturer, was incorporated in the train exhibit sent through Texas by the Southern Pacific Railroad.

Three motion pictures were completed by the Office of Motion Pictures and released for use. The titles are "Citrus fruit in Florida," "Rice from paddy to bowl," and "Wheat or weeds."

A set of 17 pictures showing the process of cotton manufacture, miniature copies of one of the exhibits at the International Textile Show, has been developed and a number of these sets have been furnished to schools.

Seven portfolios illustrating the bureau's work in cotton investigations and standardization were prepared for the foreign delegates to the conferences relating to universal standards for American cotton and for the Liverpool Cotton Exchange; for use at the British Fair at Wembley, a portfolio was made relating to the cotton-boll weevil.

Processes of color photography have been studied and indications point to a successful method for our work, which is being watched by the bureau photographer. A large vacuum printing frame which permits prints to be made from original drawings up to 30 by 40 inches has been added to the laboratory equipment, which contains several unique devices. This will be used in making enlarged charts for use in exhibits and extension work.

Work in the photographic laboratory, especially that relating to the cotton standards, has increased to such an extent that another photographer has been added to the staff.



Many writers, publishers, and educators have been furnished with prints of photographs in the bureau collection.

The hand color work has been of great service, and a large number of bromide pictures and many models of potatoes and apples have been colored for exhibition and have received much commendation. Smaller photographs have been accurately colored for use by food-products inspectors in their work.

As partially indicative of the volume of regular work performed by the photographic laboratory the following approximated figures are of interest: Negatives made, 300; prints made, 3,353; sheets of letter-size photostat paper used, 45,600.

#### RESEARCH IN CONSUMER DEMAND

The investigations of factors affecting consumer demand of farm products begun last year have been continued and expanded. This work is conducted through questionnaire surveys gathered by trained field workers by house-to-house canvass. The object of these surveys is to learn direct from consumers the relative importance of various factors which determine the rate of consumption of a given food

product. The facts secured by the questionnaire method are checked against the statistics of the distribution of the products in the given locality in order to determine the importance of various influences. Studies of this character have been made on milk in Boston, Philadelphia, and Minneapolis; on raisins in Boston, Washington, Louisville, Denver, Minneapolis, Des Moines, and Cleveland; on citrus fruits in Boston and Washington, on cranberries in Washington, and on meats at Boston and Chicago.

This work is closely correlated with studies by marketing divisions of the distribution of farm products. The results already secured show that the method followed is reliable and relatively inexpensive. The influence of various forms of publicity and advertising upon the consumption of farm products have been given particular attention. The results of these surveys have been distributed among farmer's organizations interested in the sale of each product and have been found useful in planning publicity campaigns and in estimating the value of various types and forms of advertising. Preliminary reports containing the results of surveys on milk, raisins, cranberries, and citrus fruits have been prepared during the year.









DEC 10 1924

EXHIBIT STATION FILE

## REPORT OF THE CHIEF OF THE BUREAU OF ANIMAL INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF ANIMAL INDUSTRY,  
*Washington, D. C., September 10, 1924.*

SIR: I have the honor to transmit herewith a report of the operations of the Bureau of Animal Industry for the fiscal year ended June 30, 1924.

Respectfully,

J. R. MOHLER,  
*Chief of Bureau.*

HON. HENRY C. WALLACE,  
*Secretary of Agriculture.*

### ACTIVITIES OF SPECIAL PROMINENCE

#### FOOT-AND-MOUTH OUTBREAK IN CALIFORNIA

An event of unusual importance in the work of the Bureau of Animal Industry during the fiscal year covered by this report was an outbreak of foot-and-mouth disease in California. Infection was first discovered in two herds of dairy cattle in the vicinity of Oakland, Calif. Within an hour after the telegram was received, on February 23, announcing a positive diagnosis, the Secretary of Agriculture issued a quarantine order and the bureau office force was busily engaged in preparing telegrams ordering picked, experienced men to proceed to California to reinforce the bureau and State forces in that State, notifying railroads and stockyard companies, preparing press notices, dating and sending out circular letters and other literature which had been prepared for such an emergency, and forwarding office supplies, including forms for reporting the field work. Livestock sanitary officials and Government inspectors throughout the country, especially west of the Mississippi River, were promptly advised regarding the appearance of the disease in California. In addition, radio stations cooperated with the department in broadcasting warnings and advising livestock owners to watch for symptoms of the disease and to report

promptly any suspicious cases to either the State or Federal officials.

Headquarters were established at Oakland and Dr. Rudolph Snyder, inspector in charge of the field forces regularly assigned to California, who had previous experience in foot-and-mouth disease eradication work, was placed in charge of the bureau field forces. At the request of the bureau Dr. S. E. Bennett, who had directed bureau forces in the outbreaks of 1902, 1908, and 1914, who happened to be in California at the time of the outbreak, was appointed on April 1 to serve in an advisory capacity to Doctor Snyder. The State cooperative activities were headed by G. H. Hecke, director of agriculture, and Dr. J. P. Iverson, chief of the State division of animal industry. County and municipal officials and public-spirited stockmen, also the representatives of numerous organizations and various business interests, extended their support and assistance to the Federal and State officials in a united effort to eradicate the disease.

California was very fortunate in having a well-organized division of animal industry, which, under the leadership of its chief, Dr. J. P. Iverson, was able to place a large number of trained veterinary inspectors in the field immediately following verification of the diagnosis of foot-and-mouth disease.

Director G. H. Hecke, of the California department of agriculture, early realizing the seriousness of the situa-

tion and recognizing the effectiveness of unified control, requested Gov. Friend W. Richardson to wire Secretary of Agriculture Wallace asking the U. S. Department of Agriculture to take full command of the fight. Following this request the State and Federal forces were combined under the direct supervision of Dr. U. G. Houck, of the U. S. Bureau of Animal Industry, effective April 24, 1924. This plan adopted by the California authorities is the first instance in this country in which such a method of cooperation has been established to fight this plague.

Up to the time that the bureau assumed entire charge, cooperation between State and Federal forces in California was all that could be expected, but Director Hecke was of the opinion that maximum coordination of efforts within the State could be secured under one command. This, he believed, would give livestock sanitary officials of other States greater confidence in the work and thereby facilitate negotiations with respect to modification of conflicting and, in some instances, unnecessary and unreasonable quarantines against agricultural products from California.

Director Hecke was also of the opinion that in the invasion of California by such a dangerous foreign epizootic as foot-and-mouth disease, not only was the livestock industry of California menaced, but that of the Nation as well, and the fight to exterminate it was as much, if not more, a national than a State problem.

Many obstacles not encountered in previous outbreaks have had to be overcome in this one. Among them has been the spread of the disease to large range herds and flocks in a rough, inaccessible, and poorly fenced country suffering from the worst drought experienced in 30 years. It was only through the prompt inauguration of the campaign of eradication and the assignment of the largest and best trained force ever assembled in one State on foot-and-mouth disease work that the infection was kept from becoming so widespread as to defy control.

The source of this outbreak is unknown at present, but it is believed that the infection was carried to California from the Orient. The disease first appeared in hogs that were fed on garbage obtained from ships which docked at the Mare Island Navy Yard, San Francisco Harbor.

As in previous outbreaks, the policy of promptly slaughtering infected

herds, the cleaning and disinfecting of infected premises, and the remuneration of owners was adopted immediately, as that procedure had proved to be effectual in previous outbreaks and seems to be the only certain way of protecting, so far as possible, the Nation's eight-billion-dollar livestock industry against the disease.

Rapid progress was made in stamping out the disease in the three counties, Alameda, Contra Costa, and Solano, in which it first appeared and to which it was confined until March 22. On that date infection was discovered in a large herd of range cattle in Merced County. Shipments that left that county for slaughter before the disease was discovered there carried infection to stockyards in Los Angeles, Stockton, and San Francisco. From Merced County the infection was also spread to Madera County. The outbreaks in Merced, Madera, and Los Angeles Counties were extensive and serious, and control was not established until early in May. Other counties in which outbreaks occurred were Mariposa, Kern, Stanislaus, San Bernardino, Orange, Tulare, Tuolumne, and Fresno. In this group outbreaks have been limited and have been eradicated or appear to be under satisfactory control.

At the end of the fiscal year the disease was well under control, but infection recurred in exposed areas, necessitating continued careful supervision. Further discussion of the outbreak, including a summary of animals slaughtered and their appraised value, appears in this report under the work of the Field Inspection Division.

#### CONTINUED PROGRESS IN TUBERCULOSIS ERADICATION

In the cooperative campaign to eradicate tuberculosis the results continue to be highly satisfactory. The number of herds officially accredited as free from tuberculosis increased from 28,526 to 48,273.

In addition, the plan of eradicating tuberculosis from circumscribed areas, with the county as the unit, met with public approval, as shown by the rapid growth of area testing. During the year additional counties conducted area testing and were practically freed from tuberculosis. The total number of counties which have completed area testing or were conducting such work at the end of the fiscal year was 318. A number of packers are paying a premium of 10 cents per hundred-weight for hogs originating in "modified accredited areas," which is a designation for areas containing less than



one-half of 1 per cent tuberculous cattle.

During the year the bureau gathered much new information from field sources on the prevalence of tuberculosis among swine and poultry.

The field work has been aided in large degree by the thorough analysis of reports and special studies made of numerous problems. For instance, the bureau has determined the number of tests required to free badly infected herds from tuberculosis, the prevalence of tuberculosis among calves, the portions of the animal's body where obscure lesions are likely to be found, and an abundance of similar information. Data of this kind are useful to inspectors when addressing meetings and in correspondence.

A map showing the extent of bovine tuberculosis in the United States at the close of the fiscal year has been prepared for use in poster form. This graphic means of showing where the disease is most prevalent is virtually a war map for use by livestock sanitary officials in suppressing tuberculosis.

#### MEAT INSPECTION MAKES NEW HIGH RECORD

The Federal meat-inspection service, which last year reached the highest mark in its history, when the animals slaughtered under inspection exceeded 73,000,000, set a still higher record for the fiscal year just ended. The new record is 79,814,060. This is an increase of more than 6,400,000 over the preceding year. The figure indicates an increase in total meat consumption throughout the country, as would be expected in view of the increasing population.

Through negotiations with Government officials of France and the Netherlands, conducted through the State Department, the exportation of fresh frozen pork to those countries is now permitted. To satisfy the requirements of those countries, which formerly barred this product on the ground of possible infection from trichinae, all fresh pork intended for them is specially refrigerated and inspected. The meat is frozen continuously for not less than 20 days at a temperature not higher than 5° F. Investigations conducted by the Zoological Division have shown that such treatment is complete protection against trichinae.

#### BUREAU OF DAIRYING ESTABLISHED

Pursuant to the act of Congress (Public, No. 156, 68th Congress) and

Memorandum No. 492 of the Office of the Secretary, there was established in the department July 1, 1924, a Bureau of Dairying. The activities of the Bureau of Animal Industry heretofore conducted by the Dairy Division have been transferred to the new bureau, together with personnel and equipment. Dr. C. W. Larson, who was chief of the Dairy Division, is chief of the Bureau of Dairying. The account of the Dairy Division's work contained in this report is, therefore, its last report as a division. Persons desiring to know of the department's dairy work are advised to apply in the future to the Bureau of Dairying for such information.

The creation of the new bureau is largely a recognition of the valuable work which the Dairy Division has conducted for many years, of public sentiment favoring greater prominence of such work, and the gradual growth of department dairy activities, both in number and importance. The Bureau of Animal Industry wishes the newly created bureau a continued career of public service and extends its cooperation in the achievement of that goal.

#### CONTINUED INTEREST IN LIVESTOCK IMPROVEMENT

The systematic plan of improving livestock by inducing farmers to use purebred sires continued to make good progress. During the year 2,836 persons filed with the bureau written agreements pledging themselves to use only purebred sires for all classes of stock kept and to follow progressive methods of livestock breeding. The number brings the total of participants to 14,369, owning well over 1,500,000 head of breeding stock. The interest was distributed chiefly throughout about 20 States. Those most active were Kentucky, Ohio, Virginia, South Carolina, Vermont, Oklahoma, and West Virginia.

With the growth of the work the economic benefits are becoming more and more evident. A report from Oldham County, Ky., credits purebred-sire activities with producing over \$100,000 a year more in increased returns from farm animals and their products. This amount is virtually a premium for quality. The principal improvement occurred in cattle, poultry, hogs, and sheep in the order named. This county has 248 participants in the "Better Sires—Better Stock" campaign.

Pulaski County, Va., is another area which has improved its livestock to a degree that has attracted widespread attention. At the end of the fiscal

year it had 578 participants in the work and was gradually approaching freedom from scrub sires. In four years' time purebred breeding stock, including horses, cattle, swine, and sheep, increased in numbers from 501 to 1,253. These increases range from 90 to more than 500 per cent for the different classes of livestock, averaging 150 per cent. The results in the two counties mentioned are typical of others doing active work under the plan mentioned.

To meet the large demand for information and assistance on livestock improvement the bureau prepared new educational literature, posters, exhibits, and news material. Experience has shown that many communities have a keen desire to improve their livestock, and their need is largely for suitable material and sound methods for proceeding. A new popular service is that of supplying copies of an outline for conducting scrub-sire trials. Such events, as outlined, have entertainment value, as well as being educational, which makes them suitable for picnics, field days, fairs, livestock sales, and other agricultural gatherings. Schools are also making use of the outline in connection with debating-society work. In addition to the novelty of such events a wholesome amount of permanent good results from having juries of farmers listen to the evidence for and against inferior breeding stock.

Supplementing its educational efforts for better breeding the bureau issued during the year a Handbook for the Better Feeding of Livestock. This contains a large quantity of practical feeding information in condensed form and has been in great demand, 50,000 copies being distributed within a few months after publication.

#### UNITED STATES RANGE LIVESTOCK EXPERIMENT STATION

The bureau's facilities for studying livestock problems were greatly increased by the acquisition in April, 1924, of the old Fort Keogh Military Reservation, in Montana, through a transfer to the Department of Agriculture by an act of Congress. The new station, to be known as the United States Range Livestock Experiment Station, contains 57,000 acres, 2,000 of which are under irrigation.

In accordance with the provision of this act it is expected that this station will provide for investigations in livestock production with meat-

producing animals under conditions prevailing in the range area, also investigations with feed and forage production in connection therewith.

The station will be conducted in cooperation with the Montana Agricultural Experiment Station. Full cooperative relations will be maintained in those phases of the problems related to range livestock production which pertain to the special work of other branches of the department and with the State agricultural experiment station at Bozeman, Mont. The management and operation of the station will be under the immediate direction of the Animal Husbandry Division of this bureau.

This station affords an opportunity for solving many problems that are pressing and need immediate attention. The working out of these problems will pave the way for the more fundamental studies of livestock production.

#### PERSONNEL

At the beginning of the fiscal year there were 4,197 employees in the bureau service. During the year 617 new appointments were made, 30 employees were transferred from other bureaus or departments, and 37 former employees were reinstated, making 684 additions to bureau forces. During the same period 544 employees were separated from the service, 195 by resignation, 30 by death, 21 by transfer to other branches of the Federal service, 4 by removal for cause, and 9 by retirement under the provisions of the act of May 22, 1920, while other separations numbered 285. At the close of the fiscal year the bureau rolls contained 4,337 names, an increase of 140 for the year. This increase is more than accounted for by the added appointments necessary on account of the foot-and-mouth disease outbreak in California.

#### VETERINARY EDUCATION

The number of accredited veterinary colleges whose graduates are eligible to take the civil-service examinations for positions in the bureau remained at 15, although one private college which had only a senior class during the school year 1923-24 will not reopen for the school year 1924-25. The graduates of three agricultural colleges with two-year veterinary courses are given credit for work completed in these institutions when entering one of the accredited veterinary colleges. The number of foreign veterinary col-



leges accredited by the bureau remains at 10.

The total number of freshmen enrolled in all the accredited veterinary colleges in the United States and in the one in Canada for the school year 1923-24 was 158, as compared with 176 for the preceding year. The total student enrollment was 571, as against 738 the year before. The number of veterinarians graduated was 160, as compared with 241 in 1923.

#### LITERATURE, EXHIBITS, AND MOTION PICTURES

The bureau contributed 119 new and revised publications, including 55 Farmers' Bulletins, 7 Department Bulletins, 2 Yearbook papers, 13 issues of Service and Regulatory Announcements (including index), 5 articles for the Journal of Agricultural Research, 5 Department Circulars, 5 miscellaneous pamphlets, and 27 orders in the nature of regulations. In addition, the bureau planned and issued 5 new posters. Sixty-one manuscripts were prepared for outside publication in scientific, agricultural, and other journals. Revised editions of the Special Reports on Diseases of the Horse and Diseases of Cattle were issued as congressional publications. In addition, the bureau furnished to the Press Service of the department 171 articles and items for the information of the public.

In cooperation with the department's Office of Exhibits, the bureau prepared exhibits for numerous agricultural expositions, shows, and fairs. This form of public information has received favorable comment as a means of acquainting the public with bureau activities. Special exhibits for the National Dairy Exposition and the International Livestock Exposition were especially well received. Several compact styles of portable folding exhibits were developed for the use of small fairs and the bureau field forces. Exhibits of that kind constructed thus far have dealt with tuberculosis eradication, tick eradication, purebred sires, roundworms of swine, and stomach worms of sheep.

A number of new motion pictures were prepared during the year by the department's motion-picture office from scenarios prepared in the various offices of the bureau. Among the new pictures are: "Sir Loin of T-Bone Ranch," which deals with beef production on the range; "The Woolly West," a sheep picture; "The Green Barrier," which deals with problems of

livestock production and pasture improvement in the Piney Woods region of the South; "Bob Farnum's Ton Litter," a story of swine production and management in the Central West; and "Clean Herds and Hearts," a four-reel film dealing with tuberculosis eradication by the area plan. All the pictures contain pleasing stories which make them entertaining as well as educational. The bureau cooperated with other branches of the department in planning subject matter for other films.

#### REPORTS BY DIVISIONS

The year's work as conducted by the various divisions of the bureau is presented more fully in the following pages.

#### ANIMAL HUSBANDRY DIVISION

The work of the Animal Husbandry Division, consisting chiefly of research in animal husbandry, including poultry husbandry, was conducted under the direction of Dr. L. J. Cole, chief of the division.

In addition much attention was given to promoting livestock improvement in the United States, in cooperation with other branches of the department and with State agricultural colleges. Representatives of the division attended the Western States extension conference at Fort Collins, Colo., November 5 to 9, 1923, and assisted in planning the seven-year development program that was adopted by that conference. Since then the division has aided in carrying out the program. A wider use of purebred sires, better feeding of farm animals, and the saving of young animals are some national problems that the division has emphasized.

Facilities for animal research were greatly broadened by the acquisition, in April, 1924, of a tract of 57,000 acres in Montana, to be known as the United States Range Livestock Experiment Station, which was transferred by act of Congress to the department for the study of range livestock problems.

#### ANIMAL HUSBANDRY EXPERIMENT FARM

The Animal Husbandry Experiment Farm at Beltsville, Md., was further developed as a laboratory for studying animal-husbandry problems. Its permanent equipment for experimental work, its personnel of trained assistants accustomed to such work, and its nearness to Washington make it well



sued to its purpose. Many State experiment stations, several national organizations and farmers, as well as other offices of the department, are cooperating in the studies at Beltsville.

A nutrition laboratory has been completed at the Beltsville farm. Studies of animal nutrition are planned which relate to the influence of food substances and the condition of the animal on its growth and reproduction. This laboratory cooperates in studies relating to poultry, swine, sheep, goats, cattle, horses, and meats.

The experimental abattoir at the Beltsville farm has been equipped with a laboratory for the study of meats and meat products. This laboratory is cooperating in the study of the soft-pork problem and also is investigating different methods of curing meats and their effect on the nutritive value and palatability of the meats.

#### ANIMAL GENETICS

The analysis of new data from the inbreeding and crossbreeding experiments with guinea pigs strengthens and extends the conclusions reached in Department Bulletins 1090 and 1121. Further progress is being made constantly in the study of special phases of the work. An investigation of sterility is being made.

In applying the conclusions reached with guinea pigs to swine several brother-sister matings have been made and the first-generation litters have been obtained in the Tamworth and Poland-China breeds.

New methods of determining inbreeding coefficients have been worked out and applied to the study of Short-horn cattle. These methods are applicable to any of the pure breeds of livestock for which complete pedigrees exist.

A study of the factors which determine certain types of abnormalities in guinea pigs has been made and the results published. A considerable number of new color varieties have been produced, leading to a better understanding of the heredity and development of coat colors of mammals in general. Progress is being made in the study of other special traits of the guinea pig.

#### BEEF-CATTLE INVESTIGATIONS

Investigations in the production, wintering, and fattening of beef cattle were conducted in the Appalachian region, the Corn Belt, the Cotton Belt, and the range areas of the West,

Northwest, and Southwest, in cooperation with the respective State agricultural experiment stations. The Bureau of Agricultural Economics, the Bureau of Plant Industry, and the Forest Service of the department have cooperated in some of these studies.

#### FATTENING STEERS IN THE CORN BELT

A five-year investigation on methods and costs of fattening cattle in representative feeding areas in Illinois, Indiana, Iowa, Missouri, and Nebraska has been completed. Approximately 100 feeding records have been taken annually in each State, involving a total of more than 100,000 head of beef cattle. Farmers' Bulletin 1382, "Fattening Steers in the Corn Belt," includes a discussion of the work for the first four years. Complete data are being compiled for another publication.

#### BEEF PRODUCTION ON THE RANGE

Investigations similar to those in the Corn Belt have been under way for two years in Texas and Colorado to determine the relative merits of various methods of producing range cattle. Progress reports have been published covering 41 ranches in Colorado, having 22,285 breeding cows, and 15 ranches in Texas, with 38,511 cows.

Grazing experiments are being continued at Ardmore, S. Dak.

An experiment in wintering steers was begun at Ardmore, December 4, 1923, to determine the effects of various methods of winter feeding on the gains made on pasture during the following grazing season.

Three lots of calves were fed at the department's field station at Big Springs, Tex., from December 6, 1923, to May 28, 1924, to determine the relative values of home-grown feeds for the fattening of steers and the practicability of finishing cattle during the winter months in this section of the range area. A similar experiment was conducted at the field station at Tucumcari, N. Mex., from December 1, 1923, to April 9, 1924. Wintering rations for cows, yearling heifers, and calves were compared in experiments at the northern Montana substation at Havre.

#### WINTERING STEERS IN THE APPALACHIAN REGION

An experiment begun in December, 1922, at Lewisburg, W. Va., is being continued to study the growth of weanling calves, yearlings, and 2-year-old steers fed various winter rations

followed by summer grazing on blue-grass pasture. Ninety head of Texas range-bred steers purchased as calves in the fall of 1922 are being used and will be marketed as 3-year-old grass-fat steers in the fall of 1925.

#### FEEDING BEEF CATTLE IN THE COTTON BELT

A project begun in March, 1923, on 320 acres of cut-over longleaf pine land at McNeill, Miss., is being continued to compare the effects of burning native pastures on the vegetation, the gains of cattle grazed thereon, and the reforestation which takes place. The work of improving the herd, begun in 1920 with native cows, is being seriously handicapped by the suspension of tick-eradication work by the local authorities.

At Jonesboro, Ark., the experiments in feeding purebred beef cattle were concluded October 5, 1923, and the results are being prepared for publication. A project to compare the relation of feed consumed to the quantity and quality of meat produced by purebreds, grades with three-fourths and one-half pure blood, respectively, and scrubs was begun June 17, 1924.

At Jeanerette, La., the experiment to compare various kinds of silage for fattening steers was concluded, and the project comparing various rice by-products for fattening steers is being continued.

#### CONFORMATION AND MEASUREMENTS OF CATTLE

The relation of conformation and skeletal measurements to total dressing percentage and to the weights of wholesale cuts has been investigated, in conjunction with the Wisconsin Agricultural Experiment Station, from the records of a herd of crossbred cattle. The shape of the skull in purebred and crossbred polled animals and the effect of sex on skull shape have also been studied.

#### BREEDING FOR MILKING QUALITY IN BEEF CATTLE

The experiment begun September 1, 1915, at Manhattan, Kans., in cooperation with the State agricultural college to determine to what extent milk production can be developed without sacrificing desirable beef type has been discontinued. The data obtained are now being tabulated and studied.

#### SWINE INVESTIGATIONS

Swine investigations have been conducted at the bureau's experiment farm at Beltsville, Md., at several field stations, and cooperatively at State agricultural experiment stations.

#### SOFT-PORK INVESTIGATIONS

Further study of the soft-pork problem gave a better understanding of the nature of the trouble and pointed to some practical questions which this investigation should answer. Experiments involving 373 hogs were conducted in cooperation with the State stations of Alabama, Georgia, Indiana, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee, including 29 hogs from a North Carolina farm; also independent experiments with 288 hogs were carried on at bureau farms, making a total of 661 hogs.

Since the beginning of the work five years ago data have been obtained on 2,619 hogs. During the last year the hogs were fed on peanuts, peanut meal, soybeans, rice by-products, chufas, and corn, alone or supplemented with other feeds, to determine the influence of feed on the firmness of pork. Other factors which might influence firmness were studied, including initial weight of the hogs, degree of finish, rate of gain, and influence of softness in the dam on her pigs when the pigs are grown and finished on nonsoftening feeds.

A conference of representatives of the agencies cooperating in the soft-pork investigations was held at Knoxville, Tenn., April 29 and 30 and May 1; 1924, and adopted the following conclusions:

1. Soybeans grazed or self-fed alone or with minerals self-fed through a period of from 7 to 8 weeks to pigs beginning at approximately 100 pounds weight and making gains of from 40 to 50 pounds produce soft carcasses. The degree of softness of the carcass increases as the gain in weight of a hog on this feed increases.

2. Soybeans grazed or self-fed alone or with minerals self-fed to pigs beginning at approximately 100 pounds weight and making at least a moderate rate of gain through a period of from 7 to 8 weeks will not produce firm carcasses even though a subsequent gain in weight has been made by the pigs on corn and tankage equal to that previously made on the soybeans.

3. Soybeans grazed or self-fed with a supplementary ration of 2½ per cent of shelled corn with or without minerals self-fed produce soft hogs when the pigs are put on the feeds at approximately 100 pounds weight and make at least a moderate rate of gain through a feeding period of from 7 to 8 weeks. The degree of softness of the carcass increases as the



gain in weight of a hog on this feed combination increases.

4. Rice polish and tankage self fed "free choice" on oat or rye pasture or in dry lot and with or without a small supplement of skim milk hand-fed to pigs beginning at from 35 to 125 pounds weight and making gains of 30 pounds or more through a feeding period of from 8 to 15 weeks produce soft carcasses.

5. There is a direct relation between immaturity and softness in pigs. When pigs are fed on ordinary feed combinations which are not unusually low in fat content, such as corn and tankage, or corn, middlings, and tankage, on pasture or in dry lot, and slaughtered at a weight of approximately 100 pounds or less, they are, in the usual case, soft.

6. Hogs fed corn and tankage gradually become firmer as they mature or take on weight and finish. While hogs fed in this way are usually soft at 100 pounds or less, the hardening is progressive, so that when slaughtered at approximately 175 pounds or more they are, in the usual case, hard.

7. Brewers' rice and tankage self-fed "free choice" on oat pasture with or without a small supplement of skim milk hand-fed to pigs beginning at approximately 60 pounds weight and making gains of from 150 to 200 pounds through feeding periods of from 12 to 15 weeks produce, in the usual case, extremely hard hogs, in fact, of a degree of firmness distinctly greater than that occurring in corn-fed hogs.

8. The mixture of corn meal 5 parts and peanut meal (hull-free) 1 part self-fed with or without supplementary minerals to pigs beginning at approximately 80 pounds weight and making gains of approximately 100 pounds through a feeding period of from 9 to 10 weeks produces, in the usual case, hard or medium hard hogs.

9. Results have shown that when the softening feeds and feed combinations (peanuts or soybeans alone, soybeans supplemented with a 2½ per cent ration of shelled corn or rice polish and tankage, each with or without minerals) are fed to pigs which have previously received no softening feeds there is a distinct relation between the degree of softness which develops and the weight at which the pigs began on the feed. The degree of softness which develops in the pigs decreases as the beginning weight increases, provided equal gains in weight are made and other factors are uniform. Whether the lighter pig of the higher degree of softness or the heavier pig of the relatively lower degree of softness will be hardened more readily by the subsequent feeding of hardening feeds is still undetermined. Experiments to settle this question are now in progress.

The foregoing conclusions are based on results obtained from more than 800 hogs.

A report of the results obtained in the soft-pork investigations to the close of the fiscal year is being prepared.

Samples of fat from all hogs used in the soft-pork studies were analyzed. A total of 1,900 refractive index determinations were made and the melting points and iodine numbers of a large number of the fat samples were determined. Studies were made of about 50 samples of lard produced by

all the feed combinations used in the experiments.

#### SLAUGHTER AND CURING TESTS

A total of 736 hogs were slaughtered at the experimental abattoir at Beltsville, Md., during the year. The average live weight of these hogs was 210 pounds. The average dressing percentage was 80.92. Government-owned hogs slaughtered at the Beltsville abattoir yielded \$7,150.87 through the sale of meats. The receipts from the sales of carcasses belonging to the State experiment stations were returned to the respective stations. Records were obtained on live weight, warm- and cold-dressed weights, comparative cutting yields of heavy, medium, and light hogs, and on results of curing the meat cuts from hard, soft, and oily carcasses by both the dry-salt and pickle cures.

#### OTHER WORK RELATING TO SWINE

Studies were continued at Ardmore and Newell, S. Dak., and Huntley, Mont., on the comparative cost of producing feeder pigs and market hogs in those sections of the country where pasture and grain crops are uncertain because of climatic conditions. The results are being checked against feeder pigs fattened in the Corn Belt.

Experiments to determine the effect of vitamin deficiencies in a ration on the reproductive functions of animals, the relative value of feeds for economic pork production, and the value of pork as human food when produced with different feeds are being conducted in cooperation with the Biochemical Division of the bureau.

Experiments on the effects of lice and worms on the development of hogs from birth to maturity have been continued in cooperation with the Zoological Division.

Experiments to determine the minimum age at which pigs can be successfully and permanently immunized against hog cholera are being continued in cooperation with the Biochemical Division.

A study of the prevalence, cause, and inheritance of hernias in swine has been made in cooperation with the Wisconsin Agricultural Experiment Station. While hernias in swine may result from a variety of causes, an inherited predisposition to their formation appears to be the most important cause.

Changes occurring in the vagina which are correlated with external signs in the ovarian cycle (periods of



"heat") in swine have been investigated in cooperation with the Missouri Agricultural Experiment Station.

## SHEEP AND GOAT INVESTIGATIONS

### FARM-SHEEP INVESTIGATIONS

Farm-sheep investigations were continued at the bureau's experiment farm at Beltsville, Md., at the United States Morgan Horse Farm, Middlebury, Vt., and at field stations at Newell, S. Dak., and Havre, Mont.

At Beltsville experiments for the development of a practical system of forage-crop pastures demonstrated that sheep and lambs can be grown successfully by using such forage crops as the entire summer pasture; that by a system of rotation of forage-crop pastures lambs can be successfully grown to market weight without visible effects of parasitic infestation; and that the frequent changes of pasture made possible by this system are beneficial but not entirely adequate in the control of parasites in sheep carried throughout the year. A study of the effects of "flushing" (extra feed at breeding time) on lamb yields was conducted along lines similar to those followed last year, and the results show an increase of 27 lambs per 100 ewes as a result of this practice. Type fixing in Southdown, Shropshire, Hampshire, and Corriedale sheep was continued by selective breeding based on the bureau's detailed sheep-scoring system.

At Middlebury a flushing experiment showed an increase of 16.4 lambs per 100 ewes as a result of extra feed at breeding time. The grading up of farm sheep was continued by breeding western ewes and their offspring to purebred Shropshire and Southdown rams and selecting the best ewe lambs for the breeding flock. These lambs are selected on type conformation and desirable fleece production as recorded by the scoring system. Experiments in the relative economy of early and late lamb production showed for the fourth consecutive year a greater net profit in the production of late lambs.

Studies in the growth of sheep were continued at both Beltsville and Middlebury, where weekly weighings are made of all growing stock and bi-weekly weighings of mature stock.

Farm-sheep investigations were begun at Newell, S. Dak., in the fall of 1923, with 25 western range ewes and 20 purebred Hampshire ewes. Complete feeding, weighing, breeding, lambing, and wool-production records

are being kept. Studies are being made on the relative value of range ewes and purebred Hampshires in the production of market lambs and the usefulness of cull range ewes when handled under both irrigated and dry-land farm conditions. Lamb yields were especially good at Newell this year. The flock contains 112 sheep and lambs.

Studies in cooperation with the Montana experiment station were begun at Havre, Mont., with some Shropshire and Rambouillet sheep which are being grown under the farm conditions that prevail in the northern Great Plains region.

### RANGE-SHEEP INVESTIGATIONS

The problem of producing an adequate forage supply for sheep on the range is receiving principal attention at the United States Sheep Experiment Station at Dubois, Idaho. Detailed forage maps of the experimental areas are being made, and careful records are being kept of the effects of various grazing systems on both the forage and the sheep. Other range problems, such as methods of watering sheep on dry grazing lands, wintering range sheep, and shed lambing, are also being studied.

The range-sheep-breeding work that was begun at Laramie, Wyo., 10 years ago is now yielding useful results at Dubois. During the last year a system of measuring the types of range sheep that has been developed was applied to a band of 1,200 ewes. Half of them are Rambouillets and the other half are of the crossbred type, consisting principally of Corriedale grades from a Columbia foundation. This band is being used in an intensive study of market-lamb production.

### WOOL AND OTHER ANIMAL FIBERS

Studies of wool growth have been made to determine the behavior of wool while growing under normal and adverse conditions. The work in wool scouring, to determine the grease, dirt, and clean-wool content of individual fleeces, was continued, and special tests were made to determine the accuracy of the results. Some mill tests of wools produced by Rambouillet, crossbred, Corriedale, and Columbia sheep at Dubois were conducted at the Lowell Textile School at Lowell, Mass. The results of these tests have furnished valuable information concerning the manufacturing value of these wools. Studies in the identification of

animal fibers are being made, and the results will be communicated to the fiber committees of the Federal Specifications Board.

#### MILK-GOAT INVESTIGATIONS

Continued improvement was made in the bureau's herd of milk goats at the Beltsville farm, which now numbers 53 goats of Toggenburg and Saanen breeding. The breeding up of common American does by means of purebred sires of heavy milking strains has been carried to the fifth generation with good results. The demand for good milk goats in the United States is greater than the supply. They can not be imported from Europe because of the presence of foot-and-mouth disease in goat-breeding sections there. Therefore, on account of the scarcity of purebred goats in the United States, the breeding of American grade does to purebred bucks seems to be the best way to meet the demand for good milk goats.

#### HORSE AND MULE INVESTIGATIONS

##### BREEDING AMERICAN UTILITY HORSES

The project for the development of a breed of native American utility horses for general farm and ranch work, conducted in recent years at Buffalo, Wyo., in cooperation with the State of Wyoming, was transferred at the beginning of the fiscal year to Laramie, where it is conducted in cooperation with the University of Wyoming. Several stallions produced in this project have stood for public service during the year. Studies of range production of horses have been begun, and investigations of the virility of stallions are now under way. Eight foals were produced during the year, four by the Thoroughbred stallion Glaisdale and four by the Standardbred stallion Harvest Aid. The animals produced show improvement in quality and adaptation to range utility purposes.

##### BREEDING MORGAN HORSES

The quality of the animals produced in the project for breeding Morgan horses at the United States Morgan Horse Farm, Middlebury, Vt., has been improved by careful matings and rigorous culling of inferior stock. While increased size has not been emphasized, records indicate that there has been a gradual increase in height and weight of the horses produced. Stallions from this project stood for pub-

lic service throughout New England, and breeding stock was sent to many parts of the United States and to Porto Rico, Guam, Japan, and Central America. The surplus animals produced at the farm do not nearly meet the demand.

The stallion Bennington 5693 is being used more extensively than heretofore and is proving to be an exceptionally satisfactory sire. This stallion, which was produced in this project, was awarded the championship at the Eastern States Exposition, at Springfield, Mass., in September, 1923.

In the annual eastern endurance test held at Avon, N. Y., Major S., a grade Morgan, and Gladstone, a purebred Morgan, both bred by the department, finished in the minimum time allowed.

#### CERTIFICATION OF ANIMALS IMPORTED FOR BREEDING PURPOSES

Under the provisions of paragraph 1506 of the tariff act of 1922 the bureau issued certificates of pure breeding for 1,474 cattle, 624 sheep, 316 horses, 14 swine, 1,474 dogs, and 10 cats, a total of 3,912 animals.

#### POULTRY INVESTIGATIONS

Extensive changes were made during the year in the poultry plant at the Beltsville farm to make it more suitable for conducting experimental work.

##### POULTRY BREEDING

About 7,500 chicks were hatched with good results. Practically 1,000 pullets of last year's raising were carried throughout the winter, and rigid selection was made in the spring, based on size of eggs and earliness of maturity. A special study of the inheritance of egg production is being planned, with White Leghorns and Rhode Island Reds as the principal stock. Barred Plymouth Rocks are kept for the purpose of studying the inheritance of various sex-linked factors and for the production of baby chicks for experimental feeding. Inbreeding work with White Leghorns is being continued.

##### POULTRY FEEDING

The experimental feeding work was devoted largely to determining the influence on egg production and the hatchability of eggs of various kinds and amounts of vitamins in rations fed to laying hens. No conclusions can yet be drawn.

The experiments to determine the relative efficiency of mash rations con-



taining animal proteins and those containing vegetable proteins supplemented with mineral salts have been continued. The results bear out those of previous years' work to the effect that the addition of mineral salts to vegetable proteins makes them compare favorably with animal proteins as a protein supplement for poultry.

A study is being made of the effect of the feeding of thyroid gland on the development of secondary sexual characters in poultry.

An experiment was conducted to determine the effect on rate of growth of feeding milk to growing chicks. Although the experiment is still in progress, the results warrant the conclusion that the addition of milk to the regular grain rations of growing chicks leads to a greatly increased rate of growth.

#### SOUTHWESTERN POULTRY INVESTIGATIONS

At Glendale, Ariz., a number of experiments were conducted on the fattening of turkeys for market, in which it was demonstrated that the grains grown in the Southwest are quite suitable for fattening purposes. Other experiments were conducted in turkey raising, and some feeding tests were made to compare different proteins in the rations of laying hens.

#### DAIRY DIVISION

The Dairy Division, under Dr. C. W. Larson, chief, continued its investigations in the production, manufacture, and utilization of dairy products. Researches in fundamentals which have to do with the efficiency of milk production, manufacture of products, and sanitation were enlarged. In order to do this without additional funds it was necessary to discontinue some of the extension and service work previously carried on.

The new special nutrition barn and laboratory at the experimental dairy farm, Beltsville, Md., has been completed and adds greatly to the facilities for studies in the nutrition of dairy cattle. The introduction of results of studies into practice progressed favorably.

#### DAIRY INTRODUCTION

In the course of work for the introduction and improvement of dairying representatives of the division made 1,430 visits to farms and factories and attended 781 meetings, at which they addressed 42,456 persons. Material prepared (sometimes in cooperation

with other branches of the department) included charts, photographs, motion pictures, exhibit material, lantern-slide lectures on the feeding and management of dairy cows and the manufacture of farm butter, and bulletins on the care and management of dairy bulls and cows. A plan for a campaign to promote the use of good dairy bulls was worked out.

Educational "milk-for-health" campaigns, with the purpose of increasing the use of milk as a means of reducing undernourishment and improving health, particularly among children, were conducted on the county basis in cooperation with State extension departments. According to reports from county agents, the increase in the consumption of milk where campaigns were conducted ranged from 9 to 25.5 per cent. Other work done consisted of the preparation of material for use in the campaigns and for follow-up work by the States.

#### COW-TESTING ASSOCIATIONS

The tabulation and study of cow-testing association records were continued. Records of 61,200 association cows show an average production of 6,274 pounds of milk and 257 pounds of butterfat. This is more than 50 per cent above the estimated average production of all the dairy cows in the United States. All association records available over a period of five years of continuous testing show a constant gain for each year. From the information at hand it appears that there are approximately 730 active cow-testing associations in the United States as compared with 627 a year ago.

A study was made to determine the accuracy of several methods of obtaining records in cow testing as compared with daily records of actual production. The method in general use at present in cow-testing associations was found to be accurate within 2 per cent on milk and 3 per cent on butterfat.

Improvements were made in the method of obtaining reports from associations and in the printed forms used for that purpose.

Two manuscripts for bulletins and one lantern-slide lecture on cow-testing association work were prepared.

#### BULL ASSOCIATIONS

The Dairy Division has continued to promote the formation of cooperative bull associations and to study their work. Nineteen associations



were organized during the year. A lantern-slide lecture was prepared and a Farmers' Bulletin rewritten.

Further reports on the comparative production of the daughters of bull-association bulls and of their dams have been obtained. Records of 94 dams and their daughters show an increase in production of 19.71 per cent in milk and 20.49 per cent in butterfat by the daughters over their dams.

#### CREAMERY MANAGEMENT

A study was undertaken to determine the optimum temperature of pasteurizing sweet cream to be made into butter for storage. Two creameries in Minnesota making butter for the Navy under the supervision of the division made trial lots of butter from cream pasteurized at different temperatures for varying lengths of time, and the butter was stored at a low temperature for future examination and comparison of results.

A study of the cost of hauling milk and cream was continued. Figures were obtained from creameries in Pennsylvania, Minnesota, and Wisconsin.

Data on the unit cost of manufacturing butter were obtained from five additional creameries in continuation of a study to determine the relative cost of items comprising the total cost of making butter, the range of seasonal cost variation, and the total cost in plants producing varying quantities.

The Grove City Creamery, Grove City, Pa., has completed the ninth year of its operation under the supervision of specialists from the Dairy Division. Its products during the year consisted of market milk and cream, ice-cream mix, butter, condensed and evaporated skim milk, condensed buttermilk, Swiss cheese, Roquefort cheese, and cottage cheese. The high quality of the products commanded good prices. The price paid the farmers for butterfat exceeded the New York market quotations for 92-score butter by more than 7 cents a pound.

An effort was made to aid creameries to improve the quality of butter through cream grading. Increasing the efficiency of creamery operation also received attention. The value of standardizing butter in composition and quality was demonstrated. The results are being prepared for publication.

Educational butter-scoring contests were conducted in the West, in which 1,043 samples of butter from 197 creameries were scored.

#### CHEESE MAKING

Work for improving the quality of Swiss cheese made by American factories was continued. Excellent results were obtained from the use of bulgaricus and eye-forming cultures and from clarifying the milk and adjusting the fat and casein ratio.

In Wisconsin efforts were concentrated on five factories that had been making a large percentage of under-grade cheese. At one factory part of the cheese was made by the regular method and part by an improved method. When the cheese was sold, that made by the improved method brought from 4 to 5 cents a pound more than that made by the old method. At another factory the percentage of fancy cheese was increased from 32.3 to 93.5. In all factories a marked improvement in quality was obtained.

In Ohio nine factories with which the division cooperated made 3,342 cheeses, of which 87.8 per cent were either fancy or No. 1. A group of factories using the improved method paid an average of \$2.45 per 100 pounds of milk, while another group using the old method paid but \$2.16.

In an experimental project in the manufacture of Swiss cheese at Boone, N. C., 80 per cent of the experimental cheese was either fancy or No. 1.

The division continued to cooperate with the States of Tennessee and North Carolina in an effort to develop the manufacture of Cheddar cheese. The manufacture of cheese in the mountain districts of the South has become a profitable industry.

An investigation in the manufacture of Roquefort cheese from goats' milk was undertaken in cooperation with the Dairy Husbandry Division of the University of California at Davis, Calif. A total of 1,486 pounds of cheese was made. The average score of all samples at from 4 to 5 months was between 93 and 95 points. Studies were also made in the manufacture of Roquefort cheese from mixtures of goats' and cows' milk. The results indicate that 50 pounds of cows' milk mixed with 200 pounds of goats' milk will increase the per cent of fat in the cheese and decrease the fat losses in the whey.

#### RENOVATED BUTTER

The inspection of renovated-butter factories and of materials used in the manufacture of renovated butter was continued. The output of renovated butter was 3,931,084 pounds, as com-

pared with 4,003,403 pounds for the preceding year. Exports amounted to 9,330 pounds, an increase of about 50 per cent over the preceding year.

#### BUTTER FOR THE NAVY

In the season of 1923 the Dairy Division supervised the manufacture of 1,125,000 pounds of sweet-cream butter for the Navy Department. The average score of the butter after storage for approximately 10 months was 92.77 points.

#### STUDENTS' JUDGING CONTESTS

The division supervised the students' national contests in judging dairy cattle and products in connection with the National Dairy Show at Syracuse, N. Y., October 5-12, 1923. Teams representing 29 colleges or universities in the United States and Canada participated in the cattle-judging contest and 7 teams in the products contest. The second Eastern States contest in judging dairy products, held in connection with the Eastern States Exposition at Springfield, Mass., September 19, 1923, was also supervised by the division. Teams from six colleges competed.

#### WESTERN DAIRY INTRODUCTION

In connection with the work of dairy introduction in the Western States 13 cow-testing associations were organized; approximately 150 cream-cooling tanks with running water were installed as a result of efforts of the division specialists; about 60 sets of plans and blue prints for buildings were distributed; and 242 samples of cheese from 50 cheese factories were scored and reported on.

#### MARKET-MILK INVESTIGATIONS

At the request of city boards of health and milk inspectors several cities were visited by representatives of the Dairy Division for the purpose of training the local forces in farm and country inspection and standardizing work in laboratories. In accordance with the program decided on, less work of this kind than in former years was done, and more time was devoted to research.

Five milk contests in the interest of milk improvement were supervised in the eastern part of the country, and in the western territory 43 surprise milk contests were held in 29 cities, and 1,907 samples of milk and cream were scored.

#### MILK-PLANT MANAGEMENT

Labor costs and requirements in milk plants in 26 cities were studied, and results covering more than 100 plants were reported in circular letters issued from time to time for milk-plant operators. Six country milk-shipping stations were carefully studied as to floor plans, methods of operation, and details of management.

#### EFFECT OF FEEDS ON FLAVOR AND ODOR OF MILK

Experiments to test the effects of certain feeds on the flavor and odor of milk were continued. Reports on cabbage and potatoes were prepared for publication. It was found that feeding an average of 14.3 pounds of cabbage one hour before milking produced objectionable flavor and odor in the milk, and increasing the quantity intensified these flavors and odors. Cabbage fed in quantities up to 25 pounds immediately after milking, however, caused practically no disagreeable flavor. Potatoes had practically no effect on the flavor and odor of the milk, regardless of when they were fed.

In further extensive experiments in feeding garlic the garlic odor was found to persist in milk drawn from 6 to 7 hours after feeding. It was also found that the inhalation of the odor from garlic by cows for 10 minutes without their eating any of the garlic was sufficient to cause pronounced garlic flavor and odor in the milk drawn 2 minutes later. The garlic flavor was not found in the milk drawn 1½ hours after inhalation.

The transmission of garlic flavor through the blood of cows was also tested. When 2 pounds of garlic tops were fed and blood was drawn at various intervals, the garlic odor was not found present until from 30 to 45 minutes after feeding.

Green rye was fed to cows, and 1,177 opinions on flavor and odor were obtained on 236 samples of milk. While the judges were able to detect it slightly when 15 pounds were fed one hour before milking, and the abnormal flavors increased somewhat when the quantity fed increased to 30 pounds, the flavor and odor imparted were not such as would be objectionable to the average consumer. Thirty pounds of green rye fed immediately after milking had practically no effect on the flavor and odor of milk.



## CLEANING MILKING MACHINES

Further tests were made in the cleaning and sterilization of milking machines. Three methods involving a comparison of chlorine with salt and chlorine showed little difference in results, milk of a high grade being produced by all three. Investigations to determine the life of the teat-cup liners are being continued.

## OTHER STUDIES ON MILK AND CREAM

Research work on the creaming property of milk, carried on in co-operation with the State board of health of Minnesota at the university farm and at various commercial plants in the State, was completed and a report of the results prepared.

Further investigation into the factors affecting the viscosity of cream confirmed results previously reported and yielded some additional data. The aging of raw cream below 10° C. increased the viscosity in fairly regular sequence up to 96 hours. Comparison of cream separated by gravity and that separated centrifugally, each having the same fat percentages, showed that the former had a higher viscosity at all temperatures at which tests were made (from 5° to 80° C.).

The laboratory work in a study of the relative number of bacteria in whole milk, skim milk, and cream was completed and a report prepared.

## DAIRY RESEARCH LABORATORIES

While the technical work of the dairy research laboratories has a practical bearing on dairy problems and contributes to dairy science, much of it is unsuitable for detailed description in a report of this kind. Results are published from time to time in Department Bulletins and technical journals.

## MANUFACTURE OF MILK PRODUCTS

**Evaporated and condensed milk.**—Several problems in the manufacture of evaporated and condensed milk were studied. Bacteriological work on a larger scale and under more carefully controlled conditions confirmed earlier observations on the effect of the lactic-acid bacteria on the coagulating temperature of evaporated milk. Some preliminary work was done on the problem of preparing an evaporated milk properly modified for infant feeding. Eight cases of such milk were sent to the Tropics for trial under tropical conditions. Some work was done on the substitution of a purified

dextrose for cane sugar in sweetened condensed milk.

**Milk powder.**—The chemical work on the changes in milk powder has progressed to a point at which it is possible to explain the relation of acid to the deterioration of butter, milk powder, and other products of a similar nature. This information has a practical bearing on the occurrence of rancidity and tallowiness in such products. A fat content beyond a certain concentration greatly decreases the keeping quality of milk powder. Homogenization seems to improve the keeping quality of whole-milk powder.

**Ice cream.**—A study was made of the conditions governing the crystallization of lactose, an undesirable feature of ice-cream manufacture, and certain technical information was gained. Some work was done on the influence of various ingredients on the flavor of ice cream.

**Cheese.**—An organism believed to be responsible for a troublesome, abnormal fermentation often encountered in making Swiss cheese was identified, and experiments are being continued with a view to finding a way to overcome its effects. Additional details of the use of the cream separator, or clarifier, for improving the quality of the "eyes" in Swiss cheese were worked out. Further information has been obtained on the process of making the so-called loaf Swiss cheese.

In experiments in the manufacture of Parmesan cheese the greater part of the experimental cheese failed to develop the essential sharp flavor and the texture was not sufficiently brittle. A few cheeses, however, developed the characteristics of typical Parmesan cheese.

The manufacture of Roquefort cheese at the Grove City Creamery was continued. It has been found that the fineness of the inoculating powder and the diameter of the punch holes are a factor in determining the growth of the mold, and that there is a greater demand for a moister cheese with extensive mold development.

## UTILIZATION OF DAIRY BY-PRODUCTS

Concentrated sour milk was made successfully in the Grove City Creamery by developing an acidity of 1.5 per cent in the milk by the use of special cultures. When this is done it is not necessary to homogenize the milk. A product is obtained which has a smoother, more satisfactory texture than is obtained with ordinary buttermilk.



A number of modifications have been made in the method for making soluble whey powder which will make it possible to manufacture a powder with a higher protein content. A method of regulating the salt content of whey, which has given good results in laboratory experiments, is being tested on a practical scale at the creamery.

#### NUTRITION AND MILK SECRETION

In the investigations on nutrition and milk secretion of dairy cows some progress was made in working out methods for the determination of amino acids.

The work on the relation of the nature of the feed to the assimilation of calcium and phosphorus confirmed earlier observations indicating that the kind and quality of the hay is an important factor in determining the calcium balance. Data with regard to the effects of feeding timothy and alfalfa hay were obtained in a balance experiment covering a period of 25 weeks.

#### DAIRY EXPERIMENT FARM

The principal improvement at the dairy experiment farm at Beltsville, Md., was the erection of a new barn to be devoted exclusively to nutrition work, and especially designed to facilitate balance experiments. While the crops raised in the calendar year 1923 were not so large as in 1922, they were good enough to show a profit. The leased farm is being cleared at slack seasons and seeded to grass, as originally planned.

An experiment to compare a grain mixture with alfalfa hay fed to dairy cows to determine the relative nutritive values of these feeds and the best methods of estimating nutrients was concluded. The cows were divided into two groups of four each and fed by the reversal method, one group receiving a large amount of hay and a small amount of grain, the other a small amount of hay and a larger amount of grain. It was found that 1 pound of the grain mixture had a nutritive value equivalent to that of from 1.8 to 1.9 pounds of alfalfa hay.

Another experiment to determine whether it is better to feed cows a liberal quantity of hay with a small quantity of silage or a small quantity of hay with a large quantity of silage showed a substantial difference in favor of the latter method. In order, however, to bring the consumption of nutrients to standard it was necessary to feed more grain to the cows receiving the smaller quantity of hay.

A comparison of feeding hay once and twice a day, involving the use of 8 cows for two periods of 30 days each, gave varying results and indicated that the number of times a day that hay is fed is not in itself a matter of much consequence.

Work with various mixtures for feeding calves was continued.

Work is being continued to determine the increase in production when cows are milked for whole lactation periods three times a day instead of twice. It appears fairly certain that when cows are milked twice a day the diminution in milk yield from month to month is faster than when they are milked three times a day.

#### DAIRY CATTLE-BREEDING EXPERIMENTS

The project on the relation of conformation to production in dairy cattle is progressing and a considerable amount of data is accumulating. In the preceding year outward measurements and the weights of the corresponding internal organs were obtained on 362 animals slaughtered at Chicago. This year similar data were obtained on 15 cows of known producing ability at the Beltsville farm. State agricultural colleges and experiment stations have contributed data on additional animals.

Observations and photographs as to changes in udder development and other features have been systematically made on 65 cows and calves in the Beltsville herd. Complete body measurements of more than 80 cows and calves have been made. Serial photographs showing the development and size of animals from birth to maturity are being taken. The changes that take place in the cow's udder at different stages of the lactation period are being studied.

The five herds of dairy cattle owned by the bureau had a total of 498 head on June 30, including 426 purebred animals (149 males and 277 females). The large number of bulls is accounted for by the fact that purebred bulls are lent out for the purpose of proving their transmitting ability. Seventy-four bulls are now on loan.

In accordance with the practice of giving every purebred female a record under official test regulations, 44 records were made in the five herds and showed an average of 13,733.2 pounds of milk and 513.8 pounds of fat. This completes 174 records made by 131 cows in the five herds, with a grand average of 13,420.5 pounds of milk,

and 515.34 pounds of butterfat at an average age of 4 years and 3 months.

The outbreeding and linebreeding project at Beltsville with Holstein-Friesian and Jersey cattle is being continued.

#### DAIRY-CATTLE EXPERIMENTS IN MONTANA

Experiments with dairy cattle under semiarid range conditions were continued at the department's field station at Huntley, Mont. For the last three years experiments have been carried on to test the effect of top dressing with manure on the carrying capacity of pastures. The average for three years was 1.57 cows per acre for manured pasture and 1.37 for unmanured pasture, the pastures being irrigated at intervals of from 10 to 14 days. Records of weight of cows in relation to various factors are being kept. Comparisons are being made of rations consisting, respectively, of roughage alone, limited grain, and full grain, with results so far indicating that the limited grain ration is the most profitable.

#### DAIRY ENGINEERING AND TECHNOLOGY

Plans and specifications were prepared for construction work, equipment, and apparatus required by the division, including the two story and basement concrete nutrition barn and laboratory at the Beltsville farm. At the Grove City Creamery an increased water supply is under construction. Apparatus was designed and constructed for the laboratories at Washington, Beltsville, and Grove City.

Information was furnished on the construction of dairy buildings and other problems in dairy engineering in reply to inquiries on those subjects. Problems in electrical and refrigeration engineering in which the different divisions of the bureau as well as some other bureaus of the department are concerned were studied. Plans and specifications were prepared for electrical equipment for temperature and humidity control and for refrigerators, and advice was given in the selection of machinery for special uses.

### MEAT INSPECTION DIVISION

The Federal meat inspection, conducted by the Meat Inspection Division, under Dr. R. P. Steddom, chief, shows the largest volume of slaughter in the history of the service. As compared with the preceding year there was an increase of more than 6,400,000 in the total number of animals slaughtered (the increase being mainly in swine) and also an increase in the quantity of meats processed and in the quantity of meats and products certified for export.

#### GENERAL INSPECTION OF MEATS

Inspection was conducted at 916 establishments in 253 cities and towns, as compared with 906 establishments in 261 cities and towns during the fiscal year 1923. Inspection was inaugurated at 62 establishments and withdrawn from 48, as compared with 55 and 52, respectively, during the preceding year. All the withdrawals were on account of discontinuance of interstate business.

#### ANTE-MORTEM AND POST-MORTEM INSPECTIONS

The ante-mortem and post-mortem inspections are given in Tables 1 and 2:

TABLE 1.—*Ante-mortem inspection of animals*

Class of animals	Passed	Suspected <sup>1</sup>	Condemned <sup>2</sup>	Total inspected
Cattle	9,015,521	187,241	14	9,202,776
Calves	4,650,742	5,665	3	4,656,310
Sheep	11,504,939	1,790	2	11,506,731
Goats	31,255	13		31,268
Swine	54,457,323	103,597	4,209	54,565,129
Horses	4,699			4,699
Total	70,664,479	208,206	4,228	70,906,913

<sup>1</sup> This term is used to designate animals found or suspected to be unfit for food on ante-mortem inspection, most of which are afterwards slaughtered under special supervision, the final disposal being determined on post-mortem examination.

<sup>2</sup> For additional condemnations see succeeding tables.

TABLE 2. *Post-mortem inspection of animals*

Class of animals	Passed	Condemned	Total inspected
Cattle	9, 101, 729	83, 923	9, 188, 652
Calves	4, 655, 212	12, 736	4, 667, 948
Sheep	11, 493, 148	12, 853	11, 505, 001
Goats	39, 958	371	39, 779
Swine	64, 133, 811	232, 670	64, 416, 483
Horses	4, 663	36	4, 699
Total	79, 471, 321	342, 539	79, 813, 860

Tables 3 and 4 show the diseases and conditions for which condemnations were made.

TABLE 3. *Diseases and conditions for which condemnations were made on ante mortem inspection*

Cause of condemnation	Cattle	Calves	Sheep	Goats	Swine	Horses
Arthritis						8
Emaciation	1	1				28
Hog cholera						1, 849
Injuries	1					16
Metritis	1					
Milk fever	2					
Mortibund	2	1				2
Pneumonia	1					64
Pregnancy and recent parturition	1					
Pyemia						8
Pyrexia	4				2	2, 153
Septicemia	1	1				2
Swine plague						3
Tumors						76
Total	14	3	2		4, 209	

TABLE 4. *Diseases and conditions for which condemnations were made on post-mortem inspection*

Cause of condemnation	Cattle		Calves		Sheep		Goats	Swine		Horses
	Carcasses	Parts	Carcasses	Parts	Carcasses	Parts		Carcasses	Parts	
Actinomycosis	658	93, 201	30	1, 641				9	84	
Anthrax								17		
Asphyxia	5		4		18			1, 406		
Black leg	8		7							
Bone diseases	77	13	102	27	281	285		7, 652	82	
Caseous lymphadenitis					876	13	7			
Cellulitis					1			67	135	
Congestion	9	20	2		3			71		
Contamination	2	3, 067	1	1	12			1, 000	4, 734	
Cysticercus	172	1, 185	24	2	162	7		105	88	
Dropsical diseases	36				18			11		
Emaciation	6, 609		2, 185		2, 811		299	1, 316		4
Foot-and-mouth disease	821		4							
Frozen			2							
Gangrene	72		39		3			12		
Hog cholera								44, 725	13	
Hydronephrosis	1				1			28		
Icterus	123		136		1, 715		3	5, 971		
Immaturity			4, 661							
Injuries, bruises, etc	4, 158	105	334	98	692	194	5	1, 961	8, 006	
Leukemia	165		31		9			155		
Melanosis	32	5	113	4	31			161		8
Mortibund	9		12		28			140		
Neerobacillosis	8			1	2			1		
Necrosis	7	1, 078	1			28		1		
Parasitic diseases	17	27			36			30		
Phlebitis			127							
Pneumonia, peritonitis, enteritis, metritis, pleurisy, etc	7, 855		2, 321		4, 739		4	33, 470		12
Pregnancy and recent parturition	125				22			425		
Septicemia, pyemia, uremia, etc	4, 393		1, 260		1, 314		2	24, 997		8
Sexual odor	1				3			4, 514		
Skin diseases	1		2		1			101	7	
Texas fever	63		88							
Tuberculosis	56, 760	73, 794	634	546	13		1	100, 110	1, 099, 253	2
Tumors and abscesses	1, 436	3, 298	59	246	152	48		4, 314	66, 899	2
Total	83, 923	176, 093	12, 736	2, 506	12, 853	575	321	232, 670	1, 179, 301	36



Table 5 shows the total condemnations on ante-mortem and post-mortem inspections combined:

TABLE 5.—*Summary of condemnations*

Class of animals	Animals or carcasses	Parts
Cattle.....	83,937	176,093
Calves.....	12,739	2,566
Sheep.....	12,855	575
Goats.....	321	
Swine.....	236,879	1,179,301
Horses.....	36	
Total.....	346,767	1,358,535

In addition to the foregoing the carcasses of 99,003 animals found dead or in a dying condition were tanked, as follows: Cattle, 3,724; calves, 4,919; sheep, 10,864; goats, 131; swine, 79,362; horses, 3.

## INSPECTION OF MEAT AND PRODUCTS

The inspection and supervision of meats and products prepared and processed are shown in Table 6, which is a record only of inspection performed and not a statement of the aggregate quantity of products prepared. The same product is sometimes duplicated by being reported in different stages of preparation under more than one heading.

TABLE 6.—*Meat and meat food products prepared and processed under supervision*

Kind of product	"Inspection pounds"
Placed in cure:	
Beef.....	150,198,127
Pork.....	3,502,367,439
All other.....	63,494,054
Sausage chopped.....	707,601,850
Canned product:	
Beef.....	149,220,280
Pork.....	29,374,483
All other.....	4,152,443
Sterilized product:	
Beef.....	3,538,522
Pork.....	10,326,950
All other.....	2,795
Pork to be eaten uncooked.....	37,877,932
Meat extract.....	506,381
Lard.....	2,110,660,422
Lard oil.....	2,388,410
Lard stearin.....	1,665,193
Compound and other substitutes for lard.....	363,180,229
Oleo stock and edible tallow.....	57,964,553
Oleo oil.....	136,939,138
Oleostearin.....	63,590,784
Oleomargarin.....	143,560,300
Miscellaneous.....	1,865,172,102

TABLE 6.—*Meat and meat food products prepared and processed under supervision—Continued*

Kind of product	"Inspection pounds"
Horse meat:	
Cured.....	880,575
Canned.....	233,037
Total.....	9,404,895,999

The following quantities of meat and meat food products were condemned on reinspection on account of having become sour, tainted, unclean, rancid, or otherwise unwholesome: Beef, 4,436,740 pounds; pork, 8,617,169 pounds; mutton, 44,211 pounds; veal, 48,847 pounds; goat meat, 214 pounds; horse meat, 7,880 pounds; total, 13,156,061 pounds.

## MARKET INSPECTION

Market inspection, to facilitate interstate deliveries of meats and products, was conducted in 24 cities.

## MEATS AND PRODUCTS CERTIFIED FOR EXPORT

The following products were certified for export: Beef and beef products, 176,561,063 pounds; mutton and mutton products, 2,702,530 pounds; pork and pork products, 1,940,001,856 pounds; horse-meat products, 929,019 pounds; total, 2,120,194,468 pounds. In addition 3,604 certificates were issued covering the export of 85,476,692 pounds of inedible animal products.

## EXEMPTION FROM INSPECTION

The provisions of the meat inspection law requiring inspection usually do not apply to animals slaughtered by a farmer on the farm nor to retail butchers and dealers supplying their customers. The retail butchers and dealers, however, in order to ship meat and meat food products in interstate or foreign commerce, are required to obtain certificates of exemption. The number of certificates outstanding at the close of the fiscal year was 1,564, an increase of 93 over the preceding year. During the year 60 certificates were canceled, 56 on account of the dealers' retiring from business or ceasing to make interstate shipments, 3 for violations of the regulations, and 1 on account of handling only "U. S. Inspected and Passed" products.

During the year 35,422 shipments were made by retail butchers and dealers holding certificates of exemption, as compared with 36,132 shipments during the fiscal year 1923. The shipments of the year covered products as shown in Table 7.

TABLE 7.—*Shipments by retail butchers and dealers under certificates of exemption from inspection*

Product	Number	Pounds
Beef, carcasses (728 quarters).....	182	88,304
Veal, carcasses.....	37,449	3,294,959
Sheep, carcasses.....	1,480	69,097
Swine, carcasses.....	1,719	99,671
Beef, fresh.....		714,642
Veal, fresh.....		200,531
Mutton, fresh.....		132,392
Pork, fresh.....		146,017
Cured meats.....		310,087
Lard.....		38,867
Sausage.....		91,641
Miscellaneous (scrapple, lard substitutes, suet, headcheese, etc.).....		38,258
Total.....	40,829	5,224,466

During the year 71,150 interstate shipments were made of meat and meat food products from animals slaughtered by farmers on the farm, as compared with 67,579 shipments in the fiscal year 1923. The products composing these shipments are shown in Table 8.

TABLE 8.—*Shipments of farm-slaughtered products under exemption from inspection*

Product	Number	Pounds
Beef, carcasses (1,796 quarters).....	449	141,802
Veal, carcasses.....	100,898	8,832,331
Sheep, carcasses.....	2,230	99,935
Swine, carcasses.....	6,260	667,731
Beef, fresh.....		75,761
Veal, fresh.....		139,133
Mutton, fresh.....		1,547
Pork, fresh.....		201,927
Cured meats.....		422,295
Lard.....		47,724
Sausage.....		89,767
Miscellaneous (scrapple, liver, headcheese, cracklings, etc.).....		3,867
Total.....	109,837	10,723,820

## INSPECTION OF IMPORTED MEATS

Table 9 shows the inspection of imported meats and meat food products for the fiscal year:

TABLE 9.—*Imported meat and meat food products inspected and passed*

Country of origin	Fresh and refrigerated meats		Cured and canned meats	Other products	Total weight
	Beef	Other classes			
	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
Argentina.....	4,389,123	1,243,538	4,062,118	859,125	10,553,904
Australia.....	3,819	22,079	72,076		97,974
Brazil.....	6,373	31,886	63,441		101,700
Canada.....	13,262,586	6,698,863	274,652	337,968	20,574,069
Uruguay.....	441,479	403,777	5,469,094		6,314,350
Other countries.....	1,748	88,995	707,224	193,967	991,934
Total.....	18,105,128	8,489,138	10,648,605	1,391,060	38,633,931

Table 10 shows the condemnations of imported meats and the amounts refused entry on account of lack of foreign certificate or other failure to comply with the regulations:

TABLE 10.—*Imported meat and meat food products condemned and refused entry*

Product	Condemned	Refused entry
	<i>Pounds</i>	<i>Pounds</i>
Beef.....	1,091	449
Veal.....		75
Mutton.....		4,936
Pork.....	1,891	
Total.....	2,982	5,460

## INSPECTIONS FOR OTHER BRANCHES OF THE GOVERNMENT

By request of other branches of the Government, reinspections of meats

and meat food products to determine whether they remained wholesome and conformed to certain specifications were made during the year, as shown in Table 11.

TABLE 11.—*Inspections for other branches of the Government*

Branch of Government	Passed	Rejected
	<i>Pounds</i>	<i>Pounds</i>
Navy Department.....	49,294,340	2,093,652
Marine Corps.....	3,656,224	312,328
War Department.....	526,604	20,581
Interior Department (Indian Affairs).....	366,322	295
Panama Railroad.....	5,898	217
Public Health Service.....	285,639	
Shipping Board.....		7,131
Veterans' Bureau.....	191,283	
Coast Guard.....	3,365	30
Total.....	54,328,675	2,434,234

### MEAT-INSPECTION LABORATORIES

Laboratory analyses and examinations of meats and meat food products and of substances used in connection with their preparation were conducted in the meat-inspection laboratories situated in the several districts throughout the country.

The total number of samples analyzed was 53,062, of which 401 represented meat and meat food products offered for importation. Samples of 1,287 domestic and 57 foreign products were found not to be in accordance with the regulations.

Samples of water supplies, curing materials, spices, condiments, cereals, coloring materials, denaturing oils, etc., were examined. Of 2,163 water samples, 206 showed evidence of pollution. The smaller proportion of unsatisfactory samples, as compared with the preceding year, indicates a definite improvement in conditions.

Experiments with the use of sodium nitrite as a substitute for sodium nitrate were continued. The results showed that the nitrite can be successfully used in the curing of meats with certain definite advantages, the chief of which are that the curing period is shortened and a milder cure is accomplished. From the standpoint of health the use of nitrite appears advantageous, as the finished product contains no more nitrite than does the meat cured with sodium nitrate, and contains less salt and no nitrate.

Experiments with the addition of small amounts of sodium carbonate for the purpose of correcting the hydrogen-ion concentration in pickling solutions have thrown light on the process of curing and furnish a valuable starting point for further investigation.

A study of the keeping qualities of fats is in progress.

An improved method for the determination of unsaponifiable matter in fats and grease has been developed and is under test.

### LABELING MEAT AND PRODUCTS

Efforts have been directed toward simplification of approval of labels and other markings for meat and products. A very large number of names and other data in common use were covered under blanket approval for use in stencils and box dies. Such simplification is an advantage to both the inspection service and the meat-packing industry.

The number of labels and other markings approved during the year was slightly more than 14,000, just about half the number for the preceding year.

The 781 disapprovals represent a reduction due to the increased familiarity on the part of the packing industry with the requirements.

### FIELD INSPECTION DIVISION

The Field Inspection Division, under Dr. A. W. Miller, chief, has continued its activities for the control and eradication of certain diseases of livestock, the enforcement of certain livestock quarantine and transportation laws, the administration of the regulations governing the importation and exportation of livestock, and the joint regulations of the Treasury Department and the Department of Agriculture for the sanitary handling and control of hides, skins, wool, other animal by-products, hay, straw, etc., offered for entry into the United States, and in addition has conducted the field work of eradicating the outbreak of foot-and-mouth disease in California.

### ERADICATION OF FOOT-AND-MOUTH DISEASE

During the last four months of the fiscal year the work of the division was concentrated largely on eradicating foot-and-mouth disease, which appeared in California in February. To cope with this national emergency a field force consisting of 204 carefully picked employees, about 75 per cent of whom were veterinarians, was organized. Many of these men had served in previous outbreaks, but there were included also a number of promising young veterinarians whom it seemed desirable to train in preparation for future outbreaks of this disease. Still other men were selected because, in addition to all-round ability, they were skilled in riding and roping. These qualifications, though somewhat unusual for veterinarians, were almost essential in several counties.

As in past outbreaks, the customary procedure of establishing quarantine zones, of slaughtering infected and exposed herds, of deep burying with quicklime, and of paying indemnities for animals destroyed, was followed. Table 12 shows livestock slaughtered because of foot-and-mouth disease in the 16 counties involved in the outbreak.



TABLE 12.—*Livestock slaughtered in California because of foot-and-mouth disease, together with their appraised value, February 23 to June 30, 1924*

County	Herds	Cattle	Swine	Sheep	Goats	Total animals	Appraised value
Alameda.....	22	1,461	4,331	1	4	5,797	\$181,284.62
Contra Costa.....	253	6,716	3,281	42	160	10,199	426,794.57
Fresno.....	68	1,005	27	0	43	1,075	<sup>1</sup> 41,031.50
Kern.....	7	176	4	0	1	181	7,581.40
Los Angeles.....	252	11,424	8,053	14	413	19,904	<sup>1</sup> 1,494,298.95
Madera.....	14	4,541	118	8,667	14	13,340	<sup>1</sup> 260,246.50
Mariposa.....	14	1,215	340	5,614	0	7,169	85,651.00
Merced.....	127	18,690	2,098	10,605	50	31,443	<sup>1</sup> 982,190.15
Orange.....	23	481	4	0	12	497	56,208.50
San Bernardino.....	1	2	1,508	0	0	1,510	15,854.00
San Francisco.....	1	0	19	0	0	19	276.50
San Joaquin.....	7	333	0	0	7	340	17,625.00
Solano.....	5	528	518	0	64	1,110	53,271.30
Stanislaus.....	3	146	177	15	0	338	6,470.50
Tulare.....	9	577	387	0	0	964	31,287.50
Tuolumne.....	23	2,486	131	20	40	2,677	83,250.77
Total livestock.....	829	49,781	20,996	24,978	808	96,563	<sup>1</sup> 3,743,322.76
Property appraisals.....							<sup>1</sup> 64,588.51
Grand total.....							<sup>1</sup> 3,807,911.27

<sup>1</sup> Estimated.

Prominent among the field problems in suppressing the disease was the difficulty of digging trenches for many of the large range herds, particularly in rocky, mountainous, and wooded areas. Tuolumne County especially is filled with canyons and the terrain is extremely broken. To dig trenches so that carcasses of diseased animals could be covered with 5 feet of earth would have been a stupendous undertaking, in view of the rocky soil and the size of herds, which was sometimes a thousand or more. This difficulty was solved by driving the cattle into blind canyons and, after their slaughter, dynamiting the sides of the canyons so that the debris would cover the carcasses deeply. In other instances abandoned railroad cuts were used.

The control of a foot-and-mouth disease outbreak necessitates a large amount of extremely important routine work, such as the continued inspection of herds and premises, the cleaning and disinfection of railroad cars, enforcement of quarantine regulations, and maintenance of equipment for cleaning and disinfecting premises. In some localities it was necessary to provide camp supplies, so that the field forces could work most efficiently.

In addition to the activities mentioned, the Field Inspection Division experienced a heavy increase in the demand for information, conferences, and interviews. In the emergency of combating an animal disease unfamiliar to most persons in the country, such as foot-and-mouth disease, thousands of persons in official and profes-

sional activities offer their services, propose various plans, and request information often of detailed character.

The financial and legal aspects of the work are additional problems that must be met while the actual field work is in progress. Early in the outbreak it became necessary to devise means for permitting the movement of California fruits, vegetables, and other agricultural products and yet maintain the necessary safeguards to prevent the spread of foot-and-mouth infection. This action became necessary in view of State quarantine restrictions imposed by adjacent Western States and numerous others. Thirty-six States issued embargoes on California products because of the disease.

Among the more important events in the foot-and-mouth outbreak following the positive diagnosis of the disease are the following:

On March 15 all known infected herds were "under ground." The number of animals involved up to that time was: Cattle, 3,979; swine, 8,127; goats, 37; and sheep, 11.

On April 11 the department issued a statement pointing out that foot-and-mouth disease threatened no health danger to the public. This statement, which explained that the menace was almost entirely an economic one, was made at a time when misapprehension and public fears had become so great that the entire agricultural industry of California was affected.

On April 19, following fresh outbreaks of the disease after its temporary suppression early in March,

the toll of the disease had reached 350 herds. Efforts were begun at that time also to induce the governors of a number of Western States to make their State quarantines more reasonable, while at the same time preventing the spread of the disease.

On April 24 the United States Department of Agriculture, at the request of the Governor and the Director of Agriculture of California, took full charge of the campaign to eradicate foot-and-mouth disease. It established headquarters at Sacramento, with Dr. U. G. Houck, of the Bureau of Animal Industry, in charge of both Federal and State forces.

On May 6 it became necessary to warn the public of the spread of the infection due to carelessness of persons traveling from farm to farm.

On May 27 foot-and-mouth infection was reduced to a single herd. This result was possible only by the most strenuous efforts, including extremely long working hours and the use of steam shovels, dynamite, and other rapid means of digging trenches for the burial of diseased herds.

Again, on May 28, all diseased herds had been buried, and no new infection appeared until May 30. At this time the release of territory from which the disease had been eradicated was well under way.

On May 30 action was taken by the bureau, in consultation with other Federal officials, which developed a market for about 20,000 fat lambs, at the time when buyers were "bearing" the price. The action is estimated to have saved California sheepmen about \$20,000.

By June 10 foot-and-mouth disease was plainly waning. No new cases of infection had appeared for four days, the longest period without new herds being reported since the beginning of the outbreak in February. On that day, also, all infected premises had been cleaned and disinfected.

On June 20, except for occasional flare-ups, the outbreak was so effectively under control that agricultural and industrial conditions were practically back to normal. The restrictions on tourists and automobile travel within the State had been so modified that there was practically no delay or inconvenience. The system of designating approved areas for the shipment of fruits and vegetables was working well and traffic was moving without interruption.

On June 23 a conference was held at Reno, Nev., attended by livestock sanitary officials of 11 Western States

and the United States Department of Agriculture. Important modifications of State regulations were agreed upon.

On June 28 continued improvement was noted in the situation and all diseased herds had been slaughtered and buried and premises disinfected. The situation was more favorable than at any time during the outbreak, yet the department issued warnings that recurrences were likely to occur, but that they would be suppressed vigorously and promptly.

Throughout the outbreak timely press notices and other educational material were distributed regularly, thereby keeping the public fully informed.

Supplementing the foregoing information, it may be explained that the losses which other countries experience annually from the economic ravages of foot-and-mouth disease greatly exceeded the total cost of eradicating occasional outbreaks in the United States.

#### ERADICATION OF SCABIES

In the course of sheep-scabies eradication work, which was continued in cooperation with State officials, employees in the field made 23,534,002 inspections and supervised 5,065,572 dippings. There were 1,386,006 sheep found on inspection to be infected, or approximately 30 per cent less than for the preceding year. During the year the bureau also assisted State authorities in arresting outbreaks of sheep scabies in the States where the work was not regularly carried on. While the disease is still quite prevalent in a number of western range States, the inspection reports indicate that improvement has continued in all except Colorado and South Dakota.

In the work of eradicating cattle scabies in cooperation with State officials bureau employees made 3,300,037 inspections and supervised 1,208,927 dippings of cattle in the field. On inspection, 279,468 cattle were found to be infected. This was an increase of 14.5 per cent over the preceding year. An outbreak occurred in Virginia during the year, and more infection was reported in Kansas, Colorado, Nebraska, South Dakota, and Texas than during the preceding year. There has been, however, considerable improvement in the conditions in Montana, New Mexico, and Wyoming.

#### ERADICATION OF DOURINE

Intensive efforts to eradicate this disease finally were continued in coop-

eration with State livestock sanitary authorities and the Office of Indian Affairs, and considerable progress was made toward its complete suppression. A thorough round-up was made of the horses, principally belonging to Indians, in the infected section of South Dakota, and 258 were found by the blood test to be affected with dourine. It is believed, in view of the thorough work accomplished in South Dakota, that the disease in that State is now practically eradicated. The cooperative work on the Indian reservations in Arizona, however, had to be curtailed before the close of the year on account of insufficient funds allotted to the Indian agencies to furnish the required help to round up the horses and indemnify owners for the destruction of diseased animals. It is regretted that for this reason all the horses in the infected area could not be tested before the close of the year. The number of animals tested and the results of the tests are recorded by the Pathological Division.

#### LIVESTOCK SANITARY WORK IN INTERSTATE COMMERCE

In the course of supervising the interstate transportation of livestock to prevent the spread of animal diseases bureau employees at market centers inspected 21,258,393 cattle, of which 21,089 were dipped under supervision in order that they might continue in interstate commerce. Sheep to the number of 19,769,413 were also inspected for communicable diseases, and of these 1,095,046 were dipped under bureau supervision to comply with the regulations of the department or of the States at destination. Bureau employees also inspected 52,565,021 swine and supervised the immunization and disinfection against hog cholera of 509,567 for shipment to country points for feeding and breeding purposes.

Experimental work in the control of hemorrhagic septicemia was conducted at certain public stockyards in cooperation with traders and livestock exchanges to ascertain the value of vaccination in reducing losses from this disease. In connection with this activity, veterinary inspectors vaccinated 151,457 feeder and stocker cattle.

Owing to failure on the part of owners of treated cattle to report the results following treatment, data in this respect are incomplete. Of 143,560 cattle treated at the stockyards in Chicago, Indianapolis, and Wichita, re-

turns were made by owners upon 57,946 of the animals and show deaths of 662 head supposedly from hemorrhagic septicemia. This would be 1.14 per cent of those reported, or 0.64 per cent of the entire number treated.

On request of transportation companies and shippers or to comply with laws of States to which shipments were destined, bureau veterinarians inspected 12,214 horses and mules, of which 5,887 were tested with mallein, none showing reaction.

Bureau employees supervised the cleaning and disinfection of 74,558 cars, in compliance with department regulations or on request of Canadian Government officials, State officials, or transportation companies. Of these cars, 20,401 were received at bureau stations carrying animals affected with communicable diseases.

All ruminants and swine received at public stockyards were carefully inspected for foot-and-mouth disease by experienced veterinary inspectors specially assigned to that work, as has been the practice for a number of years, in order that there might be no delay in the control and eradication of the disease should an outbreak occur.

#### ENFORCEMENT OF TRANSPORTATION AND QUARANTINE LAWS

The bureau has continued to report to the Solicitor of the department, for presentation to the Attorney General for prosecution, cases of apparent violations of livestock transportation and quarantine laws. During the fiscal year there were submitted to the Department of Justice 680 cases of alleged violations of the law which prohibits the confinement of animals in cars, etc., longer than 28 hours without feed, water, and rest. The penalties imposed in the cases decided in favor of the Government amounted to \$57,475. The enforcement of this law has resulted in the provision by transportation companies of better facilities for the feeding, watering, and resting of livestock in transit. Many of these cases required special investigation on the part of bureau employees, such as interviewing witnesses and examining railroad and other records for the completion of evidence. Four bureau employees were regularly assigned to this work, although the greater part of the work of collecting evidence and preparing and submitting reports is done by bureau em-



ployees at stockyard centers in connection with their other duties.

During the fiscal year there were submitted to the Department of Justice 91 cases of alleged violations of the quarantine laws and regulations. The fines imposed in cases decided in favor of the Government amounted to \$9,450.92.

#### INSPECTION AND QUARANTINE OF IMPORTED ANIMALS

Under existing laws and regulations cattle, sheep, goats, and swine can not be imported from any country in which foot-and-mouth disease or certain other serious animal plagues exist. Owing to the prevalence of foot-and-mouth disease in England and most countries of continental Europe, importations of livestock from overseas were limited during the year to cattle from the Channel Islands and cattle and swine from Scotland. Permits for the importation of cattle from the islands were issued throughout the year, but it was required that these animals be transferred to the trans-Atlantic vessel without landing in Great Britain and that forage and bedding materials exclusively of United States or Channel Islands origin be used during the voyage.

Importations of various kinds of livestock through the different ports of entry are shown in Tables 13 and 14.

TABLE 13.—*Imported animals inspected and quarantined*

Port of entry	Cattle	Sheep	Swine
New York.....	510	-----	2
Boston.....	134	-----	8
San Juan, Porto Rico.....	-----	1	-----
Canadian border ports.....	216	4	43
Total.....	860	5	53

Port of entry	Goats	Horses	Other animals
New York.....	-----	29	97
Boston.....	-----	14	-----
San Francisco.....	-----	-----	6
Los Angeles.....	-----	-----	7
Providence.....	-----	1	-----
San Juan, Porto Rico.....	2	-----	1
Brownsville, Tex.....	-----	-----	1
Eagle Pass, Tex.....	-----	2	-----
Laredo, Tex.....	-----	2	-----
Canadian border ports.....	-----	32	-----
Total.....	2	80	112

TABLE 14.—*Imported animals inspected but not quarantined*

Port of entry	Cattle	Sheep	Swine
San Juan, Porto Rico.....	1, 640	1	90
Mexican border ports.....	54, 845	28, 806	344
Canadian border ports.....	148, 726	28, 073	5, 639
Total.....	205, 211	56, 880	6, 073

Port of entry	Goats	Horses	Other animals
New York.....	-----	636	-----
Boston.....	-----	48	-----
Philadelphia.....	-----	9	-----
San Francisco.....	-----	-----	348
Los Angeles.....	-----	-----	10
Seattle.....	-----	-----	13
San Juan, Porto Rico.....	6	124	83
Key West.....	-----	563	-----
Houston.....	-----	-----	4
Galveston.....	-----	-----	4
New Orleans.....	5	8	2
Miami.....	-----	6	-----
Port Tampa City.....	-----	1	-----
Mexican border ports.....	7, 779	5, 977	14
Canadian border ports.....	74	6, 411	444
Total.....	7, 864	13, 783	922

In cooperation with the Bureau of Biological Survey 28,413 quail from Mexico were inspected and quarantined.

As required by the import regulations, cattle were tested with tuberculin prior to shipment from the Channel Islands and after arrival at quarantine stations in the United States, with results given in Table 15.

TABLE 15.—*Tuberculin tests of cattle for importation from abroad*

Breed	Tested abroad			Tested in quarantine		
	Tested	Passed	Rejected	Tested	Passed	Rejected
Ayrshire.....	0	0	0	63	62	1
Guernsey.....	30	30	0	179	179	0
Jersey.....	308	307	1	374	373	1
Shorthorn.....	0	0	0	13	13	-----
Total.....	338	337	1	629	627	2

It was possible, through a special provision of funds by Congress, to continue the needed repairs and improvements at the Athenia, N. J., quarantine station which were begun during the preceding year.

## IMPORTATION OF ANIMAL BY-PRODUCTS

Joint Order No. 2, of the United States Treasury Department and Department of Agriculture, governing the sanitary handling and control of various animal by-products, hay, straw, forage, etc., for entry into the United States was administered with all possible care. A special effort was made to control shipments of merchandise packed in hay or straw and originating in countries infected with foot-and-mouth disease. There is a large volume of these imports of fragile articles necessitating careful packing. Many importing firms have arranged with shippers in foreign countries to use excelsior and paper for packing or to have American consular officers in the country of origin furnish certificates of approved disinfection. When not so certified hay and straw have been destroyed under supervision of bureau or State inspectors, thus guarding against its reuse as packing material or distribution for feeding or bedding domestic livestock. It seems essential that every possible precaution be taken in connection with importations of animal by-products or feeding materials of any kind from countries which are not entirely free from foot-and-mouth disease, and consideration has been given to measures which will render the existing regulations more comprehensive. Imported hides were disinfected at 48 tanneries and skins at 67 establishments in the United States.

## INSPECTION OF ANIMALS FOR EXPORT

In order to meet the requirements of various receiving governments and to assure the exportation of only healthy animals and their transportation on vessels in a safe and humane manner it is necessary to provide inspection at various ports in the United States and to supervise carefully the fitting of vessels for carrying export animals. This work has been continued under regulations of the department which, through past experience, have proved to be efficient. The number of animals of various kinds inspected for export shipment are shown in Table 16.

TABLE 16.—*Inspections of animals for export*

Kind of animals	To Canada	To other countries		Total
		American animals	Canadian animals <sup>1</sup>	
Cattle.....	658	3,025	20,360	24,043
Sheep.....	1,466	510	.....	1,976
Swine.....	32	179	.....	211
Goats.....	128	7	.....	135
Horses.....	754	2,402	4	3,160
Mules.....	64	4,163	.....	4,227
Total.....	3,102	10,286	20,364	33,752

<sup>1</sup> Animals of Canadian origin exported through United States ports.

Statistics available for 35 consignments of these cattle to Great Britain and Belgium, consisting of 19,843 head, show a loss during the voyage of less than 0.2 per cent of the animals.

Inspections of 270 vessels carrying livestock were made before clearance.

The mallein test was applied to 754 horses and 64 mules for shipment to Canada. The tuberculin test was applied to 658 cattle, with 4 reactors. Inspections of 1,466 sheep, 32 swine, and 128 goats were also made.

For shipment to other countries 15 horses and 9 mules were tested with mallein. The tuberculin test was applied to 2,247 cattle, with 11 reactors. Inspections were made of 573 sheep and 11 swine.

## TICK ERADICATION DIVISION

The Tick Eradication Division, under the direction of Dr. R. A. Ramsay, chief, continued its cooperation with the State and county authorities in 10 Southern States in suppressing Texas or tick fever in cattle and in eradicating the ticks which transmit this disease.

## TICK ERADICATION

Under the supervision of the cooperating forces, 39,845,189 inspections or dippings of cattle were conducted and more than 28,000 dipping vats were used in these official dippings. The

bureau continued to urge that special attention be given to the final work in areas released from quarantine, with the view of completely eliminating the tick from such areas. The results obtained are shown in Table 17, which indicates that during the active tick-eradication season of 1923 the ticks were completely eradicated from 73 additional counties. This table also shows the progress made in tick eradication since its beginning in 1906 and gives the status of this work at the close of the fiscal year 1924. The county being the unit in which this work is usually conducted, that unit is used in compiling the data.

TABLE 17.—*Progress of tick eradication since the beginning, and status of the work June 30, 1924*

States	Counties under quarantine July 1, 1906	Counties under quarantine June 30, 1924	Counties released to June 30, 1924	Released counties tick free	
				Nov. 1, 1922	Nov. 1, 1923
Alabama.....	67	7	60	15	26
Arkansas.....	75	39	36	16	21
California.....	15	0	15	15	15
Florida.....	58	54	4	3	3
Georgia.....	157	4	153	101	119
Kentucky.....	2	0	2	2	2
Louisiana.....	65	36	29	3	3
Mississippi.....	81	23	58	37	47
Missouri.....	4	0	4	4	4
North Carolina.....	75	13	62	40	46
Oklahoma.....	61	6	55	35	47
South Carolina.....	44	2	42	29	35
Tennessee.....	42	0	42	41	41
Texas.....	199	100	99	44	49
Virginia.....	30	4	26	(1)	(1)
Total.....	975	288	687	385	458

<sup>1</sup> No cooperation by State with bureau since November 1, 1922.

Areas were released from Federal quarantine during the fiscal year as follows: One county and parts of 3 counties in Arkansas; 5 counties in Georgia; 6 counties and parts of 2 counties in North Carolina; 1 county in Texas. During the same period the following areas were re-quarantined: Two counties in Alabama; 3 parishes and part of 1 parish in Louisiana; 11 counties and part of 1 county in Texas; 2 counties in Mississippi; 1 county and part of 1 county in South Carolina.

In several sections of the South during the past season there has been a distinct slowing up in local tick-eradication efforts, while in other sections there has been an actual loss of

ground, evidenced by the re-quarantine of territory in which tick eradication had previously progressed to a point justifying its release from Federal quarantine. This situation seems to be due to one or a combination of the following causes: Indifference on the part of cattle owners and the business interests of the community, due in some degree to a depreciated cattle market; inadequate laws, and insufficient State and county appropriations for the work of tick eradication. In the States where these conditions existed no new work was undertaken during the year, the bureau's efforts being confined to cleaning up the infestation remaining in areas previously released from Federal quarantine. Progress in these sections will of necessity be slow until adequate laws and sufficient State and county funds are available and there is a revival of local interest in the work.

#### SHIPMENTS FROM QUARANTINED AREAS

The number of cattle of the quarantined area shipped under bureau supervision to market centers for immediate slaughter was 387,819, which is a decrease of approximately 40 per cent as compared with shipments of the preceding year. The steady decline in the movement of this class of cattle has been brought about by the eradication of the tick from large range areas and by the imposition by several States of more drastic restrictions governing the movement of tick-infested cattle into or through their territory, also by the desire of cattle owners of the quarantined area to avail themselves of the more profitable and unrestricted market open to tick-free cattle, they having learned that it is feasible and profitable to ship cattle free of ticks. The latter fact is so well established that it would seem that the act of Congress which now permits the dangerous practice of moving tick-infested cattle for immediate slaughter into or through the nonquarantined areas should be amended so as to prohibit the interstate movement of tick-infested animals at any time or for any purpose, as such restrictions are now in effect through State laws or regulations in practically all States in which tick infestation exists.

The enforcement of department regulations governing the interstate movement of cattle from the quarantined area for purposes other than immediate slaughter received the careful attention of this division, a special ef-



fort being made to improve the bureau's supervision so as to safeguard completely the tick-free areas of the country to which this class of cattle is transported. It is gratifying to note that not a single case of infestation in the free area was reported during the year as the result of the interstate movement under bureau certificate of cattle of the quarantined area. In the movement of this class of cattle from the field, 424,710 cattle were inspected or dipped and certified for interstate movements. To cover these shipments 6,118 certificates were issued. At public stockyards 47,360 cattle were dipped and certified for movement as noninfectious, for which 778 certificates were issued.

#### **MOTION PICTURES IN STIMULATING TICK ERADICATION**

The use of motion pictures in preliminary tick eradication as a means of showing the proper methods of conducting the work, the benefits to be derived, and as a help in obtaining better cooperation when active work is undertaken, was extended during the year by the purchase and use of an additional portable motion-picture outfit. The two outfits in the field gave exhibitions in the rural tick-infested districts of Alabama, Arkansas, Florida, North Carolina, Oklahoma, Mississippi, and Texas. There were 378 exhibitions given to audiences totaling 60,825 persons.

#### **TUBERCULOSIS ERADICATION DIVISION**

The campaign for the eradication of animal tuberculosis, conducted by the Tuberculosis Eradication Division, under the direction of Dr. J. A. Kiernan, chief, made gratifying progress. In this joint undertaking by State, county, municipal, and Federal authorities excellent cooperation prevailed. Efforts were made by the bureau to assist State and county officials in the laying of plans looking to the complete eradication of the disease in their respective territories. Wherever sufficient funds were appropriated to insure the continuation of definitely laid plans, such plans were formulated. The eradication of tuberculosis from circumscribed areas was the most important feature of the program.

All the 48 States and the Territories of Alaska and Hawaii continued their cooperation. An average of 216 regularly employed bureau veterinarians were engaged in the work through 43 field offices. The livestock sanitary officials of the States employed an average of approximately 193 regular

veterinarians throughout the year, while the counties, cities, and other official or semiofficial agencies employed an average of about 135 regular men. These statistics show a slight decrease in the number of bureau veterinarians, a slight increase in the State forces, and a marked increase in county veterinarians.

The Federal appropriation was the same as the year before, \$850,000 for operating expenses and \$2,027,600 for payment of indemnity for tuberculous animals slaughtered. The combined State appropriations totaled approximately \$6,000,000, an increase of about \$1,000,000. That the funds were conserved to the utmost is shown by figures indicating an increase of 53 per cent in the number of cattle tested.

The four main projects of the eradication campaign were continued, namely: (1) Eradication of tuberculosis from herds of cattle under the "accredited-herd" plan; (2) eradication of tuberculosis from circumscribed areas; (3) eradication of tuberculosis from swine; (4) control of the tuberculin testing of cattle intended for interstate shipment through supervision of the work done by practicing veterinarians on the approved list and at public stockyards.

#### **ACCREDITED TUBERCULOSIS-FREE HERDS**

Tuberculin testing under the accredited-herd plan, which primarily is valuable in promoting the work in circumscribed areas, was conducted in all States. At the conclusion of the fiscal year there were listed as fully accredited 48,273 herds containing 920,370 cattle, an increase of 19,747 herds containing 305,214 cattle. In addition to the fully accredited herds, 529,018 herds containing 4,772,836 cattle passed one test in the process of becoming accredited. This is an increase of 216,737 herds and 2,048,339 cattle. The total herds under supervision at the end of the year numbered 705,906, containing 7,374,093 cattle, an increase of 305,809 herds and 2,924,371 cattle. At the end of the year there were on the waiting list 257,569 herds containing about 3,000,000 cattle.

In connection with this work and the area work (reported under another heading) the tuberculin test was applied to 455,034 herds containing 5,312,364 cattle, of which 171,559 cattle, or 3.2 per cent, were condemned as diseased. Table 18 shows by years the number of accredited herds and cattle and the number of herds and cattle that have passed one test.

TABLE 18.—*Progress of work of establishing accredited herds free of tuberculosis*

Fiscal year	Cattle tested <sup>1</sup>	Number of reactors	Per cent of reactors	Accredited		Passed one test	
				Herds	Cattle	Herds	Cattle
1918.....	134, 143	6, 544	4.9	204	6, 945	883	22, 212
1919.....	329, 878	13, 528	4.1	782	19, 021	6, 535	117, 243
1920.....	700, 670	28, 709	4.1	3, 370	82, 986	16, 599	197, 577
1921.....	1, 366, 358	53, 768	3.9	8, 201	193, 620	49, 814	643, 233
1922.....	2, 384, 236	82, 569	3.5	16, 216	363, 902	161, 533	1, 548, 183
1923.....	3, 460, 849	113, 844	3.3	28, 526	615, 156	312, 281	2, 724, 497
1924.....	5, 312, 364	171, 559	3.2	48, 273	920, 370	529, 018	4, 772, 836

<sup>1</sup> Includes testing under area plan.

The total number of tests made during the time this work has been in progress is 13,708,599, with 471,166 reactors, or 3.4 per cent.

TABLE 19.—*Status of tuberculosis eradication from county areas at close of fiscal year ended June 30, 1924*

State	Counties completing one or more tests of all cattle <sup>1</sup>	Counties intensively engaged in testing	Total counties engaged	Modified accredited areas	Cattle tested during year
Arizona.....	.....	2	2	.....	28, 191
California.....	.....	3	3	.....	14, 767
Colorado <sup>2</sup> .....	.....	.....	1	.....	8, 007
Dist. Columbia.....	1	.....	.....	.....	373
Florida.....	3	.....	3	3	1, 627
Idaho.....	3	4	7	1	87, 698
Illinois.....	1	42	43	1	354, 429
Indiana.....	6	8	14	2	105, 183
Iowa.....	1	24	25	.....	412, 997
Kansas.....	3	.....	3	2	65, 778
Kentucky.....	.....	3	3	.....	69, 162
Maine.....	.....	11	11	.....	49, 525
Maryland.....	1	2	3	.....	31, 383
Michigan.....	18	4	22	7	368, 164
Minnesota.....	3	.....	3	.....	154, 497
Mississippi.....	3	1	4	.....	3, 467
Missouri.....	12	6	18	.....	84, 713
Montana.....	2	3	5	.....	66, 672
Nebraska.....	6	1	7	.....	85, 084
Nevada <sup>2</sup> .....	.....	.....	.....	.....	16, 839
New Hampshire <sup>2</sup> .....	.....	.....	.....	.....	21, 422
New Mexico <sup>2</sup> .....	.....	.....	.....	.....	6, 073
New York.....	2	20	22	.....	281, 125
North Carolina.....	19	19	38	19	99, 484
North Dakota <sup>2</sup> .....	1	.....	.....	.....	193, 159
Ohio.....	3	9	12	.....	126, 914
Oregon.....	10	5	15	.....	78, 838
Pennsylvania.....	.....	3	3	.....	108, 431
Tennessee.....	3	.....	3	3	10, 846
Utah.....	2	3	5	.....	55, 122
Virginia.....	1	2	3	.....	15, 974
Washington.....	3	16	19	.....	95, 848
West Virginia.....	1	.....	1	.....	11, 496
Wisconsin.....	14	5	19	.....	315, 355
Wyoming <sup>2</sup> .....	.....	.....	.....	.....	17, 868
Total.....	122	196	318	38	3, 446, 501

<sup>1</sup> Including modified accredited areas.

<sup>2</sup> Testing reported done under community or township plan.

## ERADICATION OF TUBERCULOSIS FROM AREAS

Marked progress was made in the eradication of tuberculosis from cattle within circumscribed areas, with the county as the unit. The efficiency and economy of this plan as compared with the testing of scattered or individual herds has been repeatedly demonstrated. At the close of the fiscal year one or more tests of all cattle in 122 counties had been reported, representing an increase of 41 counties over the preceding year. One hundred and ninety-six additional counties were actively engaged in area work, an increase of 79.

Counties in which all the cattle have been tuberculin tested under Federal and State supervision and in which the number of reactors does not exceed one-half of 1 per cent of the total cattle are designated as modified accredited areas under the terms of B. A. I. Order 283. During the year 38 counties in 8 States were placed in this classification.

The status of the area work is shown in Table 19.

The greatest advances were made in Illinois, Indiana, Iowa, Kansas, Maine, Michigan, Minnesota, New York, North Carolina, Ohio, and Wisconsin. The plan of obtaining as much assistance as possible from counties was again given emphasis. Such assistance was provided to a marked degree in Illinois, Iowa, Michigan, New York, and North Carolina. In Iowa, under the provision of a new State law, 26 counties were authorized to levy a special tax to be used in the operation of the area plan, both for expenses and for indemnity. The sum provided in these counties was about \$750,000. Money actually spent by all counties engaged in area work increased from approximately \$133,000 in 1923 to \$443,501 in 1924.



TABLE 20.—Cattle slaughtered, appraised value, indemnity allowed, and salvage realized in work of tuberculosis eradication

State	Cattle slaughtered	Average appraisal per head	State indemnity	Federal indemnity	Average State indemnity per head	Average Federal indemnity per head	Average salvage per head
Alaska.....	13	\$150.00	\$907.79	\$315.96	\$69.83	\$24.30	\$16.49
Arizona.....	1,174	89.22	26,301.71	26,301.71	22.40	22.40	12.39
Colorado.....	321	105.15	8,152.34	8,152.34	25.40	25.40	20.91
Connecticut.....	3,823	65.78	121,472.79	59,472.16	31.77	15.56	17.83
Delaware.....	1,282	73.93	38,366.57	25,500.08	29.93	19.89	10.07
District of Columbia.....	2	100.00		49.31		24.66	26.03
Florida.....	153	24.87	1,499.15	849.50	9.80	5.55	8.16
Hawaii.....	190	206.05	10,050.00	4,101.74	52.89	21.59	51.51
Idaho.....	317	41.76	3,284.31	3,284.31	10.36	10.36	10.55
Illinois.....	9,159	72.23	166,032.24	166,032.24	18.13	18.13	16.80
Indiana.....	2,300	87.07	50,067.42	47,032.24	21.77	20.45	17.16
Iowa.....	7,881	80.92	127,538.82	127,538.82	16.18	16.18	14.48
Kansas.....	896	75.75	21,912.62	15,443.76	24.46	17.24	18.48
Kentucky.....	555	59.72	18,289.23	7,759.68	32.95	13.98	11.56
Maine <sup>1</sup> .....	380	105.74	19,457.94	8,056.18	51.21	21.20	16.03
Maryland.....	3,515	77.24	72,971.47	72,971.47	20.76	20.76	14.97
Massachusetts.....	3,170	130.88	87,853.77	87,853.77	27.71	27.71	20.07
Michigan.....	3,620	72.23	107,690.97	64,368.54	29.74	15.01	16.95
Minnesota.....	4,264	53.71	94,137.15	46,770.45	22.08	10.97	20.44
Mississippi.....	23	49.13	560.00	350.00	24.35	15.22	3.48
Missouri.....	429	124.90	11,614.23	11,420.22	27.07	26.62	21.55
Montana <sup>1</sup> .....	263	58.68	9,994.09	4,276.81	38.00	16.26	4.42
Nebraska.....	1,256	93.97	19,618.55	19,618.55	15.68	15.68	28.24
Nevada.....	45	61.09	1,022.04	854.17	22.71	16.76	19.32
New Hampshire.....	2,328	75.48	81,798.60	42,338.08	35.14	18.19	17.78
New Jersey.....	3,474	122.02	120,926.09	85,019.12	34.81	24.47	20.40
New Mexico.....	20	56.10	406.00	406.00	20.30	20.30	
New York.....	5,457	105.50	398,991.44	86,633.33	73.16	15.88	12.94
North Carolina.....	397	110.72	9,726.21	9,726.21	24.50	24.50	12.60
North Dakota.....	1,935	48.10	17,958.37	17,958.37	9.00	9.00	15.19
Ohio.....	3,547	79.26	65,870.34	65,870.34	18.57	18.57	23.90
Oklahoma.....	70	100.00	2,951.87	1,733.92	42.17	24.77	12.59
Oregon.....	1,088	88.84	20,583.59	20,583.59	18.92	18.92	11.79
Pennsylvania.....	4,525	121.86	192,928.62	126,852.80	42.54	27.97	17.32
Rhode Island.....	27	101.48	1,201.66	655.12	44.51	24.26	21.93
South Carolina.....	84	87.56	2,032.75	2,032.75	24.20	24.20	14.96
South Dakota.....	224	106.97	8,842.98	5,318.55	39.48	23.74	22.92
Tennessee.....	82	232.99	6,840.20	3,656.08	83.42	44.59	24.29
Texas.....	111	80.18	2,464.77	2,464.77	22.21	22.21	8.51
Utah.....	463	89.88	8,679.92	8,679.92	18.75	18.75	16.18
Vermont.....	1,429	67.76	20,376.35	20,376.35	14.26	14.26	11.00
Virginia.....	925	85.76	33,644.03	17,061.23	36.37	18.44	15.23
Washington.....	1,355	104.66	33,604.56	33,604.56	24.80	24.80	15.89
West Virginia.....	305	82.55	13,031.28	5,930.93	42.73	19.45	11.83
Wisconsin.....	7,650	98.47	143,568.19	143,568.19	18.76	18.76	18.40
Wyoming.....	58	76.03	893.90	893.90	15.41	15.41	8.41
Total.....	80,585	82.24	2,206,116.88	1,499,738.12	27.37	18.58	17.04

<sup>1</sup> Salvage paid to State.

## STATISTICS OF SLAUGHTER AND INDEMNITY

Statistics of the slaughter of reacting cattle, the indemnity paid, salvage realized, etc., are given in Table 20.

## ERADICATION OF TUBERCULOSIS FROM SWINE

As the work under the area plan of eradication has advanced it has been possible to give increased attention to the problem of eradicating tuberculosis from swine. In one area there were indications that tuberculosis infection in swine was contracted from tuberculous fowls. A study of this source of infection has been begun. The infection of swine from cattle was given continued attention, resulting in the testing of many herds of

breeding swine and the tracing of new centers of infection through packing-house reports on swine found to be tuberculous on slaughter.

## REGULATION OF INTERSTATE MOVEMENT OF CATTLE

The 8,371 veterinary practitioners authorized to make tuberculin tests of cattle for interstate shipment tested for that purpose 235,970 cattle, of which 2,223, or 0.9 per cent, reacted.

Bureau inspectors tested at public stockyards for interstate movement 41,419 cattle, among which there were 661 reactors, or 1.6 per cent. Permits were issued for the interstate movement of 45,051 known reactors for immediate slaughter and 2 animals



which were returned to the original owners for breeding purposes.

#### TUBERCULIN TESTING

Tuberculin tests were made by the various methods, as follows: Intradermic, 4,333,511 cattle, 112,364 reactors, 2.6 per cent; ophthalmic, 1,468 cattle, 51 reactors, 3.5 per cent; subcutaneous, 20,574 cattle, 2,127 reactors, 10.3 per cent; combination, 906,722 cattle, 56,110 reactors, 6.2 per cent.

About 34 per cent of the tests reported were made by bureau inspectors, and about 66 per cent by State and county inspectors and accredited practicing veterinarians. The work done by the accredited practitioners has materially increased, 440,581 cattle having been tested by them, in comparison with 165,827 tested in 1923 and 100,526 in 1922.

Investigations regarding the occurrence of tuberculosis in calves were continued during the first six months of the year. Reports for that period, added to numbers previously reported, cover the testing of 140,497 calves up to 1 year of age, among which there were 5,762 reactors, or 4.1 per cent. There were 3 per cent of reactors among the calves under 6 months of age and 4.8 per cent among those between 6 months and 1 year old.

In a study of the case in which no visible lesions were noted on post-mortem examination of slaughtered reacting cattle, about 65 per cent of such cases were found to have been in herds containing known cases of tuberculosis.

Continued efforts were made to conserve funds for operating expenses by systematizing the work and grouping herds or confining activities to circumscribed areas. The average cost of testing by bureau field veterinarians, including salaries and expenses supervising officers, was 30 cents a but not office expense or salaries of head, as compared with 35 cents during the preceding year and 46 cents the year before.

#### CONFERENCES AND PUBLICITY ON TUBERCULOSIS ERADICATION

The usual Eastern States conference on tuberculosis was held in Albany, N. Y., June 10, 11, and 12, 1924, and was attended by bureau and State officials, practicing veterinarians, livestock owners, representatives of breeders' associations, public health officials, county agents, and others. Numerous State and other local meetings of veterinarians and livestock owners were attended by representatives of the Tuberculosis Eradication Division.

The department's literature on tuberculosis was widely distributed. New posters on tuberculosis in swine and poultry were prepared.

#### DIVISION OF HOG-CHOLERA CONTROL

Activities for the control and reduction of hog cholera were continued through the Division of Hog-Cholera Control under Dr. U. G. Houck, chief. The methods and policies were similar to those followed in recent years. In general, the bureau veterinarians engaged in this work attended meetings and held interviews with farmers and others interested in the reduction of losses from hog cholera, visited farms to investigate conditions and determine causes of infection, examined live and dead animals to diagnose disease, treated hogs either as demonstrations or to assist practicing veterinarians, and gave advice generally on the handling of outbreaks of hog cholera.

The activities were greatly curtailed toward the close of the year by the temporary transfer of veterinarians from hog-cholera control to the eradication of foot-and-mouth disease in California. Fortunately, hog cholera was at a low ebb and the situation was favorable.

The division maintained an average of 47 veterinarians in the field for the first three-quarters of the year, while this number was reduced to about 30 during the last quarter.

The inspectors attended 971 meetings, at 722 of which they gave talks on the subject of hog-cholera prevention. Visits were made to 29,443 farms and 112,109 interviews were held with farmers, stockmen, practicing veterinarians, commercial men, and others interested in abating losses in swine. Post-mortem inspections were made on 3,686 hogs, and 77,855 hogs were treated in demonstrating the value of serum and in assisting practicing veterinarians. In cooperation with State officials 1,634 premises were quarantined and 847 were cleaned and disinfected under the supervision of bureau inspectors. From various sources 7,225 outbreaks of hog cholera were reported. Incidental to hog-cholera activities, the inspectors diagnosed other diseases of swine in 1,812 cases.

#### DIVISION OF VIRUS-SERUM CONTROL

The Division of Virus-Serum Control, under Dr. D. I. Skidmore, chief, conducted the administrative and regulatory work under the virus-serum-toxin act of 1913. This work consisted of the issuance of licenses

to establishments producing veterinary biological products intended for sale in interstate commerce; the inspection of such establishments as to sanitary conditions and methods of production; the supervision of the production and testing of products; and the issuance of permits for the importation of veterinary biological products from abroad. It also involved the consideration and disposal of claims made by firms producing alleged remedies for hog cholera and other swine diseases.

#### WORK AT LICENSED ESTABLISHMENTS

At the close of the year 94 establishments in 60 cities and towns in 21 States were operating under license and inspection, as compared with 95 at the end of the preceding year. Fifty-nine of the establishments were engaged in producing only anti-hog-cholera serum and hog-cholera virus, 28 in producing other biological products, and 7 in producing both classes. Among such products are antibacteria serums, aggressins, bacterins, vaccines, tuberculin, mallein, etc. Inspectors of the bureau supervise all operations in the production and testing of anti-hog-cholera serum and hog-cholera virus, while frequent periodical visits of inspection are made to establishments producing other products, when cultures of organisms and samples of products are collected for examination.

Inspectors examined and admitted into licensed establishments 455,384 hogs and 1,318 calves, while 274 hogs were rejected. In subsequent inspections 26,624 hogs were rejected because of conditions which made them unsuitable for the production or testing of licensed products. The inspectors supervised 11,045 potency and 9,053 purity tests of anti-hog-cholera serum and 2,522 virulence tests and 2,585 purity tests of hog-cholera virus.

One hundred and thirty-eight subcultures, embracing 283 strains of organisms intended for use in producing biological products in licensed establishments, were subjected to laboratory examination. Of these strains 244 were found to be satisfactory and 39 contaminated or unsatisfactory. Seventy-two samples of products were also subjected to laboratory examination; 57 were satisfactory and 15 contaminated or unsatisfactory.

#### OUTPUT OF BIOLOGICAL PRODUCTS

The production of anti-hog-cholera serum and hog-cholera virus by li-

censed establishments exceeded that of any previous year. The quantity of serum produced was 879,421,591 cubic centimeters, of which 672,775,376 cubic centimeters was ordinary serum and 206,646,215 cubic centimeters clarified serum. There was destroyed or withheld from market 4,086,268 cubic centimeters of hyperimmune blood and serum in an incomplete form and 5,865,339 cubic centimeters of completed product. The production of simultaneous virus amounted to 44,554,725 cubic centimeters, hyperimmunizing virus 184,276,865 cubic centimeters, and inoculating virus 725,973 cubic centimeters, a total of 229,557,563 cubic centimeters of virus. The quantity of virus destroyed in either complete or incomplete form was 11,649,701 cubic centimeters.

The production of other biological products by licensed establishments aggregated 20,340,851 doses, classified as follows: Bacterins, 8,923,323; vaccines and viruses, 5,007,363; aggressins, 3,185,310; tuberculin, 1,778,608; avian tuberculin, 51,001; mallein, 62,548; anti-sera and sera, 1,332,688.

#### EXPORTATION OF BIOLOGICAL PRODUCTS

The exportation of biological products increased greatly. As some foreign countries have issued regulations denying entrance to products which are not accompanied by a certificate issued by the bureau, such certificates are being issued in appropriate cases.

#### PREVENTING SALE OF WORTHLESS REMEDIES

Cooperative arrangements with the Bureau of Chemistry were continued with the view of preventing the marketing in interstate commerce of alleged preventives or cures for hog cholera and other swine diseases. Such remedies are usually composed of common drugs known to have little or no preventive or curative value for the diseases in question. In the course of the year a large number of such cases were handled.

#### BIOCHEMIC DIVISION

The work of the Biochemic Division, under Dr. M. Dorset, chief, consisted chiefly of laboratory research relative to meat products, investigations concerning hog cholera, studies of dips and disinfectants and insecticides, and the preparation of tuberculin and mallein.



## INVESTIGATION OF MEATS AND MEAT FOOD PRODUCTS

The chemical investigation of meats and meat food products along the lines previously followed was continued, a part of the work being conducted in cooperation with the Animal Husbandry Division.

### VITAMIN A IN MEATS AND PRODUCTS

A comprehensive study of the vitamin A content of beef, pork, and lamb, begun during the preceding year, was completed and the results prepared for publication. Ten samples of beef, corresponding to a like number of cattle, 7 samples of fresh pork, corresponding to 30 hogs, and 6 samples of lamb, corresponding to 7 sheep, were studied. The results indicate that all these classes of meat contain a certain, though not a large, proportion of vitamin A. The beef muscle, when serving as the sole source of vitamin A, in amounts up to 30 per cent of the water, did not supply sufficient vitamin A for normal growth of rats, although when the beef was increased materially the rats made normal growth. It appeared from the studies made that the pork muscle was not quite so well supplied with vitamin A as the beef, while the lamb on the average contained more than either of the other two kinds of meat.

Since the nutritive value of a fat is materially affected by its vitamin content, experiments were begun to determine the amount of vitamin A in oleo oil and oleostearin. Twenty-seven samples of these fats were collected from six important meat-packing centers, and the vitamin A values of approximately half of these samples have been determined thus far. The results show that the samples of oleo oils were very much richer in vitamin A than the corresponding samples of oleostearin pressed from the same lots of oleo stock. Yellow oleo oil was found to be much richer in vitamin A than the other grades of oil, and yellow oleostearin proved to have a higher vitamin content than several samples of nonyellow oleo oil.

A study of the vitamin A content of the livers, hearts, and kidneys from cattle, sheep, and swine is in progress. Thus far it seems to be well demonstrated that livers and kidneys from all these animals are quite rich in this vitamin, comparing favorably in this respect with egg yolk, while the samples of heart muscle have somewhat lower values. It was found that among the viscera named, beef kid-

neys were exceptionally rich in vitamin A.

### VITAMIN REQUIREMENTS OF SWINE

In cooperation with the Animal Husbandry Division, a study is being made of the vitamin requirements of growing pigs and of mature swine. It has been found that brood sows can be maintained in apparently normal condition for a year when fed rations either practically free from vitamin A or from both vitamins A and B, but the reproductive capacity of the animals is materially affected. Growing pigs were found to be more susceptible to a deficiency of either vitamins A or B in their rations. It was found also that the vitamin B content of the liver and muscle of growing pigs that had been fed a ration very deficient in that vitamin for several months was much lower than the vitamin B content of the same tissues from pigs fed a normal ration. Other experiments are in progress.

### VITAMIN REQUIREMENTS OF LAYING HENS

In cooperation with the Animal Husbandry Division, a study was made of the vitamin requirements of 10 pens of hens as related to egg production, fertility and hatchability of eggs, and the vitamin content of the eggs and of the flesh of the hens. It was found that certain vitamin deficiencies in the rations very materially affected egg production and also the fertility and hatchability of the eggs. Likewise the vitamin content of the eggs was considerably affected by the vitamin content of the rations fed the hens. The feeding experiments with the hens have been concluded, but the laboratory study is still in progress, so that the full results are not yet available.

### EMACIATION IN CATTLE

The study of emaciation in cattle has been continued when material was available. A chemical study was made of the lean meat from 8 carcasses of beef condemned on account of emaciation, these being compared with 6 thin beef carcasses which were passed for food. The results confirm previous observations and show certain clear-cut differences in the chemical composition of the cattle condemned for emaciation as compared with that of the flesh of cattle passed for food. A noteworthy difference lies in the amount of water present in the tissues as compared with the total solid material. The emaciated carcasses quite



regularly showed a higher percentage of water and a lower percentage of nitrogenous and mineral matter. It is hoped that the results may afford a chemical method for judging emaciated cattle in the enforcement of the meat-inspection law.

#### RANCIDITY OF FATS

The chemical investigations to determine what compounds are responsible for the typical odor, flavor, and chemical reactions of rancid fats progressed sufficiently to permit the publication of an extensive report in the *Journal of Agricultural Research* (vol. 38, p. 323).

Special investigation is being made of the physiological effect of rancid fats. This work is not complete, but it has gone far enough to indicate that large quantities of highly rancid fats when substituted for corresponding amounts of sweet fats in a ration otherwise adequate cause a strikingly subnormal growth. Rats fed the same rations with sweet instead of rancid fat gained practically twice as much in weight as those receiving the rancid fats in their ration.

A chemical examination of the edible viscera of meat-producing animals was made and the results are embodied in a paper now in press. Studies are also being made on methods for determining the reducing sugars in animal tissues, the present available methods being far from satisfactory.

#### INVESTIGATIONS OF DIPS AND DISINFECTANTS

In the course of laboratory work on dips and disinfectants analyses were made of 186 samples of dips, phenolic disinfectants, serums, viruses, etc.

#### FIELD TESTS FOR DIPPING BATHS

During the calendar year 1923 the laboratories prepared and forwarded to inspectors in the field, for testing the strength of dipping baths, 689 new test outfits for arsenical dips and supplies sufficient to make 758,000 field tests, 35 new test outfits for lime-sulphur dips and supplies sufficient to make 9,300 tests, and 20 new outfits for testing nicotin dips and supplies sufficient to make 3,885 tests. Extra parts for test outfits were furnished to replace breakage and loss of individual items.

#### SAPONIFIED CRESOL SOLUTION

The work with a view to improving the saponified cresol solution, which is

so extensively used for official disinfection, was continued and served to show that coconut-oil soaps in general serve to produce a more powerful disinfectant when combined with cresol than soaps produced from linseed oil or soybean oil. While the bactericidal efficiency of the disinfectant prepared with coconut-oil soap is not equal for all microorganisms, the solutions prepared in that way have always shown a certain degree of superiority over those prepared with the soaps now in use. It furthermore appears that saponified cresol solutions prepared from coconut oil may be manufactured as cheaply as the ordinary product, so that it will doubtless be found advantageous to include coconut oil as one of the sources of soap used with cresol in the preparation of saponified cresol solutions intended for official use.

New methods and modifications of accepted standard analytical methods have been devised whereby the determination of the physical properties and chemical composition of saponified cresol solutions has been rendered much more convenient, precise, comprehensive, and practicable. A description of these methods has been prepared for publication.

Practical experience has shown that in the preparation of serums, particularly anti-hog-cholera serum, the phenol added for the purpose of preservation is not always accurately added and thoroughly mixed with the serum. To meet the need for a simple means for determining the amount of phenol in the serum, a fluid-test method has been devised which appears to be sufficiently accurate and convenient to be practicable.

#### BACTERICIDAL EFFICIENCY OF DISINFECTANTS

Continued study has been devoted to the fundamental question of the mode of action of disinfectants. The substances studied have been soaps, phenols, and alcohols. The difficulty in procuring many of the substances of the required high degree of purity has necessitated the expenditure of much time and effort on synthesis and purification. The various soaps, phenols, and alcohols have been tested against a variety of microorganisms in order to determine whether or not the relationships observed are generally true or merely specific for each organism. The preliminary study of the primary, secondary, and tertiary alcohols has been completed and it has been found that each additional car-

bon atom in each series carries with it a definite and regular increase in germicidal power.

#### DISINFECTION OF HIDES

The suggestion that a solution of iodine in carbon tetrachloride would prove effective as a disinfectant for hides against anthrax has led to some study of this question. A 1 per cent solution of iodine in carbon tetrachloride was found to kill anthrax spores on hides in 24 hours but not in 6 hours. The great expense of the method, however, seems to render it impracticable.

#### TUBERCULIN AND MALLEIN

The production of tuberculin and mallein for official use by bureau and State inspectors was continued. The demand for mallein was small, the total amount supplied being only 22,235 doses. The demand for tuberculin, however, continued to increase. The diminution in the use of the subcutaneous test is more than offset by the greatly extended use of the intradermic and ophthalmic tests. The year's output of tuberculin was as follows: Subcutaneous tuberculin, 748,950 cubic centimeters, a decline of about 60 per cent from the preceding year; intradermic tuberculin, 9,454,520 doses, an increase of about 63 per cent; ophthalmic tuberculin, 2,413,500 disks, an increase of about 27 per cent. A demand for avian tuberculin has developed and preparations are being made to supply that product to bureau inspectors as required.

Considerable progress has been made in the chemical study of the tubercle bacillus and its products. It has been conclusively demonstrated that iron in the form of any of its salts, especially the citrate, or even in the form of metallic iron, when added to culture media for tubercle bacilli, exerts a very favorable influence. Tuberculin prepared from culture media containing iron has been found to be potent. The increase in growth of the bacteria caused by the iron has varied from 20 to 100 per cent. Sixteen other metals have been studied in the same way, but none have been found to exert so favorable an influence.

With the object of obtaining a better understanding of tuberculin, extensive studies of the metabolism of the tubercle bacillus were made and are nearing completion.

#### HOG-CHOLERA INVESTIGATIONS

In cooperation with the Animal Husbandry Division, studies concerning the immunization of suckling pigs

against hog cholera by the simultaneous method were continued at the department stations at Beltsville, Md.; Ardmore and Newell, S. Dak.; Huntley, Mont.; McNeill, Miss.; and Jeanerette, La. A total of 2,424 pigs were treated before weaning. There were no losses from cholera as a result of treatment. A total of 930 pigs were tested for immunity after inoculation, with a loss of 16, of which 12 were from one farm. It is believed that the conditions at this place were perhaps in large measure responsible for the losses there. So far the indications are that under normal conditions suckling pigs may be successfully immunized by the simultaneous method.

Tests of commercially produced anti-hog-cholera serum and hog-cholera virus were made, with the result that all the samples of serum were found to be of standard potency and all the samples of virus were of good virulence.

In an experiment to test the belief that hog-cholera virus after being preserved with phenol may lose its potency if exposed to high temperatures such as occur in summer, samples of virus held for short periods of time at summer temperature were apparently little affected, while longer periods of time, such as 48 hours at 86° F. and seven days at from 92° to 100° F., exerted a distinct attenuating action. On the whole, the results indicate that hog-cholera virus with 0.5 per cent phenol retains its virulence remarkably well under adverse conditions, but that in the heat of summer, with temperatures ranging from 85° to 100° F. or above, the virus should not be kept at room temperature very long, as it may suffer a serious loss of virulence under such conditions.

A study of the effect of formaldehyde on serum proteins has been completed.

#### NECROTIC ENTERITIS AND HOG "FLU"

Investigation of the condition generally referred to as necrotic enteritis in hogs was continued as opportunity offered. This disease was not prevalent in central Iowa during the past season; hence the opportunity for study was limited. The conclusions from a study on one farm where the disease existed in typical form are that the disease occurs usually on farms where cattle are being held for market and the losses may at times be serious. It seems to be quite well established that by moving the pigs to clean yards and thoroughly cleaning the yards and infected lots the trouble may be overcome. Extensive cultural



studies failed to reveal any single organism which was capable of producing the disease observed in the field. Pigs recently immunized against cholera and placed on the infected farm readily contracted disease, while others which had been treated several months previously remained well. It seems probable that the reaction which may attend the simultaneous inoculation against hog cholera predisposes pigs during that period to necrotic infection.

Hog "flu" is a seasonal disease and is observed in Iowa almost always, if not exclusively, late in the summer, in the fall, or early in the winter. The first cases observed last fall occurred at the Central Iowa Fair. Following this fair a number of herds to which hogs had been returned after exhibition developed disease in a rather acute form. By transferring sick hogs from the infected farms to the bureau station it was possible in several instances to transmit the disease to healthy pigs by pen association. The disease was also transmitted from sick to healthy pigs by pouring into the nostrils of the healthy pigs suspensions in sterile water of tracheal mucus from an infected animal. Tracheal mucus filtered through a Berkefeld filter failed to produce the disease, while the same unfiltered mucus produced the infection. This work is not completed, but it is felt that distinct progress is being made.

#### COOPERATION WITH INSECTICIDE AND FUNGICIDE BOARD

The routine examination of samples for the Insecticide and Fungicide Board was continued and certain investigative work was carried out. The bureau has furnished expert advice to the board on veterinary, chemical, and bacteriological subjects.

#### PATHOLOGICAL DIVISION

The Pathological Division, under the direction of Dr. John S. Buckley, chief, followed its usual lines of scientific investigation of the diseases of domestic animals and birds.

#### RESEARCH ON DISEASE PROBLEMS

##### BOVINE INFECTIOUS ABORTION

Further studies were made of methods of overcoming infection of *Bacterium abortus* in the udders of cows, as it is generally recognized that the udder and the lymph glands associated with it perpetuate this infection in cows between gestation periods. An experiment begun in 1922 that involved the repeated administration of

abortion bacterin (suspensions of killed abortion bacteria) with the view to eliminating such udder infection was completed. Sixteen cows which were producing milk infected with the abortion organism were divided into two groups of equal size, and one group was given six subcutaneous injections of the bacterin at brief intervals, while the other group was untreated, and the milk of both groups was tested at intervals. Six hundred and eight days after the immunizing treatment three of the treated cows, or 43 per cent (one of them having died during the experiment), were still discharging the bacteria in their milk, while five of the untreated cows, or 62.5 per cent, likewise continued to be carriers of the infection. The difference between the two groups is not considered to be sufficiently marked to justify the conclusion that the bacterin injections had any appreciable effect in overcoming the udder infection.

Other experiments consisted in inflating the infected udder with air saturated with chloroform vapor, since laboratory experiments had shown that chloroform vapor was effective in destroying the abortion organism in culture flasks. While the results were somewhat encouraging, the method has not been investigated sufficiently to justify a definite opinion.

Further evidence that living abortion organism vaccine may be advantageously used in connection with un-bred heifers in abortion-infected herds was obtained.

A series of experiments on immunization was completed and a report prepared for publication.

##### HEMORRHAGIC SEPTICEMIA

In the course of investigations with hemorrhagic septicemia the Pathological Division developed a new and very effective immunizing agent with which to combat the malady. The product is known as hemorrhagic-septicemia aggrassin and contains no germs. It is prepared from the copious inflammatory exudate produced in large domesticated animals by an injection of virulent hemorrhagic-septicemia organisms beneath the skin. Repeated tests have shown that this aggrassin produces in cattle a high-grade immunity. Immunized cattle given 500 times the fatal dose of hemorrhagic-septicemia virus showed no ill effects, while all untreated cattle succumbed within 48 hours to the same exposure.

The division prepared 865,800 cubic centimeters of hemorrhagic-septicemia bacterin and 183,370 cubic centimeters



of ant-hemorrhagic-septicemia serum and sent these products to the several stockyards cooperating in an experimental project for the control of the disease.

#### RABIES

A series of experiments on the efficiency of the single-injection vaccine for the prevention of rabies was completed. Against two "street viruses" a considerable percentage of vaccinated dogs were protected. One street virus was encountered, however, against which little or no protection was afforded vaccinated dogs. From the experimental data it appeared that this lack of protection was probably due to a peculiarity or a difference in strain of this particular virus rather than to a question of virulence.

#### DIAGNOSIS AND CONTROL OF DISEASES

##### RABIES

Specimens from 125 suspected cases of rabies were received and submitted to laboratory examination, with positive results in 92 cases, while in 3 cases decomposition prevented a diagnosis. The positive cases were 80 dogs, 6 cats, 3 cattle, 3 swine, and 2 horses. Several persons as well as a number of dogs and other animals had been bitten by the affected animals. In every instance in which a person had been bitten laboratory animal inoculations were made when the microscopic findings were negative. Most of the cases came from the District of Columbia and adjacent portions of Maryland and Virginia, but there were isolated cases from more distant States, as West Virginia, North Carolina, and Tennessee.

##### TUBERCULOSIS

Specimen tissues from 230 cattle that had reacted to the tuberculin test but had shown no visible lesions of tuberculosis on autopsy were submitted for laboratory examination. By microscopic examination, in some instances accompanied by animal inoculations, the presence of tubercle bacilli was demonstrated in 51 of the samples, while 179 gave negative results.

##### GLANDERS

Cooperative work in the control and eradication of glanders in the various States was continued. The complement-fixation test was applied to 534 samples of serum from animals suspected of being affected with or exposed to the disease, and 61 gave positive reactions.

#### DOURINE

In the course of the campaign for the control and eradication of dourine, 8,883 samples of blood serum from horses in districts where dourine exists or is suspected to exist were subjected to the complement-fixation test, and 432, or approximately 4.8 per cent, gave positive reactions.

#### TESTING ANIMALS FOR IMPORT

Blood serum from 38 horses offered for import were subjected to the complement-fixation test for glanders and trypanosomiasis before admission. Fifty-five camels and 90 Zebu bulls were admitted into the country following negative reactions of their serum to the complement-fixation test for trypanosomiasis.

The trypanosome found in May, 1923, in a lot of camels offered for importation was studied and was classified as belonging in the *brucei* group. This trypanosome was pathogenic for laboratory animals and the horse, the cow, and the sheep.

#### DISEASES OF POULTRY AND BIRDS

In the study of bird diseases more than 350 autopsies were performed on birds of many species. The following conditions were found: Coccidiosis, 96; bacillary white diarrhea, 57; colibacillosis, 13; tumors, 10; peritonitis, 11; pneumonia, 11; poisoning, 11; tuberculosis, 7; *Bacterium pullorum* infection, 7; parasitism, 7; enteritis, 7; blackhead, 6; internal hemorrhage, 6; fowl typhoid, 4; leukemia, 3; miscellaneous, 91.

Diseases affecting poultry at the animal husbandry farm, Beltsville, Md., were studied in cooperation with the Animal Husbandry Division. Some opportunities were afforded to study methods of treating poultry diseases.

#### TESTING BIOLOGICAL PRODUCTS

The testing of commercial veterinary biological products prepared under Government licenses, as well as of the cultures from which they were prepared, was continued with samples collected by the Division of Virus-Serum Control in connection with the enforcement of the virus-serum-toxin law. Samples of 37 products were examined, of which 18 were found to be unsatisfactory by reason of either lack of potency or contamination. There were also examined 266 cultures, of which 34 were found to be unsatisfactory.

## INVESTIGATION OF POISONOUS PLANTS

The investigation of poisonous plants and their effects on livestock were continued on the same general plan as in preceding years.

A field investigation of the cause of continued losses of sheep in the Routt National Forest, made at the request of officers of the Forest Service, led to the conclusion that the losses were probably due to eating wild cherry.

In another investigation on the range near Heber, Utah, it was found that the losses of sheep were caused by lupines. The range was well covered with grass, and apparently the sheep ate the lupines because of the lack of other weeds.

A well-known species of lupine, which had been determined by previous experimental work by the bureau to be distinctly poisonous, was found to be the cause of continuous losses of sheep in the region of the Wyoming National Forest.

Following the work on the woolly-pod milkweed, reported last year, three additional species of milkweeds were studied. The work on two of them, *Asclepias fremontii* and *A. vestita*, is nearing completion. Both are decidedly poisonous, while the other, *A. cordifolia*, so far as the work has gone, does not appear to be dangerous.

Work on three loco plants was carried on and is well advanced. The chemical study of white snakeroot was continued and is also in an advanced state. The field work on the rayless goldenrod is practically completed and chemical work is under way. Chemical studies of the lupines were continued.

A plant known as cayotillo, which grows in southwestern Texas and produces the disease known as "limber leg," is being investigated. While the experimental work is incomplete, it has been shown clearly that the seeds of the plant induce a remarkable paralytic effect on animals.

Incomplete studies of *Notina greeni*, a plant growing abundantly in the neighborhood of Roswell, N. Mex., thought to be the cause of losses of livestock, indicate that it is only slightly poisonous if at all, and that it is probably not the cause of the losses.

The field work on species of cockleburs is complete and the results have been prepared for publication. These plants cause heavy losses of cattle and pigs and under some circumstances may poison other animals. It has been shown clearly that the plants are poisonous only when in the very young

stage, and that internal treatment by oils or grease will, in many cases at least, cause recovery.

Two species of death camas, one found abundantly in parts of Oklahoma and the other mainly in the Pacific States, have been subjects of study. The practical field work has been completed and reports prepared.

## BRANCH LABORATORIES

The work conducted at the branch pathological laboratory at Chicago consisted largely of making diagnoses of pathological conditions encountered in meat inspection. The specimen tissues received for study and diagnosis represented a wide variety of diseases and conditions.

Cooperation was extended on several occasions to the Chicago health department and to local hospitals and medical colleges. An exhibit of fresh pathological specimens from slaughterhouses was maintained and demonstrated for five days at the annual convention of the American Medical Association.

Numerous specimens from fowls purchased by individuals in the retail markets of Chicago were submitted for examination, and the results indicated a high percentage of tuberculosis in chickens and turkeys. Examination of specimens of wild rabbits revealed infestation with intermediate stages of two species of tapeworms of dogs.

In a series of experiments concerning the so-called pin-point lesions of tuberculosis in the cervical lymph glands of swine, out of 100 guinea pigs inoculated with material from 100 such glands, 9 developed tuberculosis, while the remaining 91 showed no lesions of this disease.

Enlarged stifle joints of cattle which were suspected of being tuberculous were examined and guinea pigs were inoculated, with negative results for tubercle bacilli, but later, in cooperation with the Zoological Division, a large threadworm (species of *Oncoerca*) was found in some of the joints.

The branch laboratory at Denver, Colo., received for examination 837 specimens. Besides aiding the meat inspection, cooperation was extended to health officers, veterinarians, and stockmen.

Microscopic examinations of poultry feed showed that a large percentage of the products sold locally as meat meal contained large quantities of hair.

Roup in fowls was studied and a bacterin made from typical cases gave



satisfactory results both as a curative and a preventive agent.

An outbreak of botulinus poisoning at Sterling, Colo., in which five persons died, was investigated, and home-canned string beans were determined as the cause. The botulinus organism was found in a can of the beans and in the soil in which they grew.

### ZOOLOGICAL DIVISION

The investigation of parasitic diseases of animals and the study, collection, and determination of animal parasites were continued in the Zoological Division under the direction of Dr. B. H. Ransom, senior zoologist and chief of the division.

#### ROUNDWORMS AND OTHER INTERNAL PARASITES OF SHEEP

Experiments in stomach-worm control by means of repeated treatments were continued at the Government sheep farm at Vienna, Va., and confirmed the results of previous years as to the value of this method of control. In one experiment two lots of 10 lambs each were used, one lot being treated at monthly intervals with the 1 per cent copper-sulphate solution and the other lot not treated. Both lots were infested at the beginning of the experiment, 3 lambs had died in each lot, and all the animals were anemic. At the end of the experiment the treated lot weighed 30 per cent more than the untreated lot. In a second experiment, in which copper sulphate alone, nicotin sulphate alone, and a mixture of the two were compared, the best results were obtained with the mixture. The copper-sulphate solution alone was slightly superior to the nicotin-sulphate solution alone. The sheep resisted the administration of the nicotin-sulphate solution and occasionally collapsed and had to be revived. The mixed treatment was resisted by sheep to a less extent and collapse occurred less often. Sheep take the copper-sulphate treatment readily and collapse does not occur.

The copper-sulphate and nicotin-sulphate mixture appeared to be fairly but not completely effective in removing tapeworms. Copper sulphate alone was evidently less effective, although the experiments of past years indicate that there is usually a diminution of tapeworm infestation where repeated doses of copper sulphate are given.

Experiments at Chicago apparently confirm those at Vienna to the effect that the combination of copper sul-

phate and nicotin sulphate is more effective than either of these substances alone.

The field experiment begun in October, 1922, under actual farm conditions in Schuyler County, Mo., has continued to show excellent results. Routine dosing with copper sulphate at intervals of from 25 to 28 days has been carried out on 11 farms, to the entire satisfaction of the owners. At the close of the fiscal year 2,023 sheep and lambs were under treatment. At the close of 1923 all sheep and lambs were apparently free from stomach worms, or practically so. During the first three months of 1924 the sheep were not treated, owing to the severe winter. Trichostrongyles other than stomach worms still persist to some extent in spite of treatment, and the same is true of nodular worms. The rather light tapeworm infestation originally present appears to have disappeared. All these flocks are on permanent bluegrass pasture without change except in the fall, when they are allowed the run of meadows and fields.

The conclusions from the Missouri experiment up to the present are as follows: The routine treatment with 1 per cent copper-sulphate solution is effective in controlling stomach worms on permanent bluegrass pastures. Breeding ewes under routine treatment winter better and have a larger percentage of strong, living lambs than those not treated. Lambs under routine treatment continue to grow and improve through the summer and the death rate is practically zero. Sheep under routine treatment and properly cared for show an increase of approximately 3 pounds in the weight of fleece. This field experiment has attracted the interest and attention of the farmers and veterinarians of Missouri and adjoining States.

#### ROUNDWORMS OF SWINE

The work in McLean County, Ill., has been continued with about the same number of animals (about 9,000) and with the same success in avoiding losses from roundworms and associated diseases of pigs, as in previous years. The use of the so-called McLean County system of swine sanitation, which is based on our work in McLean County, has become widespread in the Middle West, and highly favorable reports concerning it continue to come in from the many localities where it has been put into operation. Experiments have been con-



tinued in regard to the length of time that ascarid eggs in the soil or on its surface will remain viable, in regard to infecting swine with human ascarids, and in regard to the effects of slow infection of swine by means of repeated small quantities of ascarid eggs as compared with the effects obtained by means of large quantities of ascarid eggs.

#### TREATMENT AND CONTROL OF EXTERNAL PARASITES

The project of the treatment and control of external parasites was seriously interfered with by the necessity for detailing the investigator in charge to work on the foot-and-mouth disease outbreak in California. However, the subjects investigated gave the following results: Horses with sarcoptic mange, when exposed to sulphur-dioxid gas in a 4 per cent concentration for one hour and the treatment repeated after a 6-day interval, were not cured. Four treatments of two hours' exposure each at 5-day intervals, using gas concentrations of from 5 to 10 per cent, also failed to cure advanced cases. Various methods of treating horses for infestations with biting and sucking lice were tested, and the best results were obtained by dipping or spraying with coal-tar-creosote solutions or arsenical dip.

#### TESTS OF ANTHELMINTICS

The critical testing of anthelmintics was largely along the lines of testing substances advocated by various writers with inadequate evidence for use as anthelmintics. Many of these substances proved ineffective. While these results may be termed negative, work of the sort appears to be necessary, as drugs may be enthusiastically advocated on feeble evidence, and, unless shown to be ineffective by critical test, may come into more or less general use, such use entailing a considerable waste of time, energy, and money. Some of these preparations are theoretically sound, and it requires critical test to show that the theory is not sustained by practice.

Carbon tetrachloride, which was found by this laboratory a few years ago to be effective against hookworms of dogs, has come into even more extensive use than formerly in hookworm campaigns in human medicine during the year. It has now been used in more than 100 000 cases in the Fiji Islands and in hundreds of thousands of cases elsewhere. In connec-

tion with our studies on this drug, a series of tests of chlorine compounds as anthelmintics has thrown some light on the correlations between the anthelmintic efficiency and the chemical composition and solubility of the compounds.

Attempts to remove whipworms from dogs by means of subcutaneous, intramuscular, and intravenous injections gave some interesting results, suggesting that with a suitable drug such a mode of administration might give good results.

Further studies were made on the control of strongyles in verminous aneurisms in horses by means of intravenous injections of drugs. Novarseno-benzol used in this manner proved ineffective, as had carbon tetrachloride and tartar emetic in previous tests.

#### MISCELLANEOUS INVESTIGATIONS ON ANIMAL PARASITES

Studies on the toxic effects of ascarid fluid and extracts on man have been continued and some results of interest obtained. Demodectic mange of the goat, a serious disease, was found, apparently for the first time, in the United States. Intestinal nodules due to a heterakid in chickens have been investigated, and also a nodular typhlitis in pheasants due to a similar cause. Several new parasites of domesticated animals in the United States were reported and described, and systematic studies of several genera of parasites were made and prepared for publication. Several department publications for popular use dealing with parasites of livestock were prepared or revised.

Miscellaneous studies include investigations of the effects of low temperatures and disinfectants on ascarid eggs, studies on laboratory technic in examining animals post-mortem for parasites, on the control of roundworm and filth-borne diseases, and an attempt to produce intrauterine infestation with ascarids in swine.

The index-catalogue of medical and veterinary zoology has been continued. The first part of the host catalogue is being prepared for press in collaboration with the Hygienic Laboratory of the Public Health Service.

#### EXPERIMENT STATION

The work at the experiment station at Bethesda, Md., under Dr. E. C. Schroeder, superintendent, comprised independent investigations of infectious diseases of the lower animals.

investigations in cooperation with other scientific divisions of the bureau, and the provision of facilities for other divisions to make investigations under normal farm conditions.

#### BOVINE INFECTIOUS ABORTION

Bovine infectious abortion remained the major subject of study throughout the year.

Reasonably simple and economically practicable control measures, formulated at the station and based on results obtained through its studies, have proved very encouraging and valuable in a privately owned herd of several hundred purebred cattle which was generously placed at the service of the station by its owner. A second large purebred herd has also been placed under the supervision of the station, but too recently for results to be reported.

Another herd, which has been under supervision for several years, illustrates conclusively that specific disease-control measures are not effective unless they are consistently applied. An occasional failure to do the several things necessary to prevent the introduction or dissemination of disease germs may cause the loss of the benefits derived from months or years of careful work.

Much work was done with the agglutination test for bovine infectious abortion. Results so far indicate that an animal which has been removed from all sources of infection for from five to six weeks and which does not react to the test above a certain measurable degree may be regarded as safe so far as the dissemination of abortion germs is concerned.

The work on differences between the types of the abortion germ that cause abortions, respectively, among cattle and swine has progressed to a stage where it seems probable that the *Bacterium abortus* of cattle is at least as different from that of swine as the human type of the tubercle bacillus is from the bovine. Culturally and serologically, the two types can not be distinguished from each other, but they cause somewhat different lesions in small experiment animals. While it has been easily possible to infect cattle with the bovine type through natural modes of exposure, and swine with the swine type, attempts to infect cattle with the swine type and swine with the bovine type through

natural modes of exposure have wholly failed.

In a series of experiments as to the portal through which the bacterium enters the bodies of its victims it was found that dropping a suspension of abortion germs on the surface of the eye was a very effective method of conveying infection to small experiment animals—a method which may easily occur under natural conditions. A single similar experiment on a pregnant cow was also followed by infection.

Some preliminary experiments with small animals have been made in a study of the possible immunizing properties of cultures of *Bacterium abortus* which were originally highly virulent for guinea pigs, but which during the course of long growth on artificial media had lost such virulence. Further studies were made regarding bacterins for bovine infectious abortion. Much of the research work on this disease is tedious and technical, and much time is required to reach and confirm results.

#### TUBERCULOSIS

Investigations on tuberculosis have dealt with the production of immunity against the disease, the treatment of the disease, the occurrence of tubercle bacilli in dairy products, the nature of the tuberculin reaction, the standardization of tuberculin, the types of the tubercle bacillus that occur in atypical tuberculous lesions of cattle and lesions that have unusual locations, and the significance of the decline of tuberculin sensitiveness after exposure to tuberculin.

#### MISCELLANEOUS WORK

A number of tests regarding the presence of dangerous disease viruses in suspected materials from animals were made, sera and other products required in the biological investigations of the bureau were obtained from animals, and various minor investigations were conducted. A large number of small experiment animals were raised, and every portion of available land at the station was kept under intensive cultivation to produce forage for experiment animals. Several addresses were presented at scientific and other meetings and a number of papers were contributed to technical journals.







# REPORT OF CHIEF OF BUREAU OF BIOLOGICAL SURVEY

UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF BIOLOGICAL SURVEY,  
*Washington, D. C., September 18, 1924.*

SIR: I have the honor to submit herewith a report of the operations of the Bureau of Biological Survey for the fiscal year ended June 30, 1924.

Respectfully,

E. W. NELSON,  
*Chief of Bureau.*

HON. HENRY C. WALLACE,  
*Secretary of Agriculture.*

## GENERAL ACTIVITIES AND ORGANIZATION

The work of the Bureau of Biological Survey has to do with the conservation of the useful and otherwise valuable wild bird and mammal life of the country, including species classed as game and as fur bearers. This involves the administration of certain Federal laws, including among others the migratory bird treaty act and laws for the protection of land fur animals in Alaska. The bureau is charged also with the duty of controlling certain species which, through their feeding habits or excessive increase in numbers, have become seriously injurious to agriculture, including many kinds of crops, horticulture, forestry, and stock growing on the western ranges. In addition, with its efforts to conserve and build up the wild life of Alaska, the bureau conducts investigations and experiments to develop the reindeer industry, and to utilize some of the numerous islands in the Great Aleutian Reservation for stock-growing purposes. These activities are all based on scientific investigations, which include extended field and laboratory studies.

The only change in organization during the year has been the separation of the section having to do with the development of fur production, including fur farming, from the

Division of Economic Investigations, and its establishment, effective July 1, 1924, as the Division of Fur Resources, in charge of Frank G. Ashbrook.

The work during the year was conducted under six divisions, as follows:

1. Economic Investigations, Dr. A. K. Fisher, in charge. Necessary investigations of injurious wild mammals and methods for their control are conducted by this division and the leadership and organization furnished for cooperative and other campaigns against predatory animals and destructive rodents throughout the country. Through experiments in fur farming, and in other ways, studies have been made of problems in fur production and the development of the fur industry.

2. Food Habits Research, W. L. McAtee, in charge. In this division are investigated the food habits and economic relations of birds, reptiles, and amphibians, the food resources of water areas for migratory wild fowl, and methods of control of injurious birds, and basic recommendations are made in these particulars.

3. Biological Investigations, E. A. Goldman, in charge. Field and laboratory studies are made of the wild life of the country, including mammals, birds, reptiles, amphibians, and the more characteristic native plants. This includes technical investigations

to determine the classification of species, also their life habits and distribution, including the migratory movements of birds, for the purpose of mapping the natural life zones of the country and of supplying fundamental scientific information as the necessary basis for the economic, regulatory, and other activities of the bureau.

4. Alaska Investigations, the chief of bureau and W. F. Bancroft, in charge. All problems affecting the improvement and management of reindeer herds are studied in this unit; fur production is encouraged through advice to fur farmers and the enforcement of laws and regulations for the protection of land fur animals in the Territory; and possibilities of utilizing certain islands for stock grazing are investigated.

5. Game and Bird Refuges, Smith Riley, in charge. This division supervises the maintenance of 69 Federal large game and bird refuges and the warden service on them, including the production of hay for feeding elk on the Winter Elk Refuge at Jackson, Wyo.

6. Migratory Bird Treaty and Lacey Acts, George A. Lawyer, Chief United States Game Warden, in charge. Under this division are administered laws for the protection of migratory game and other birds, and laws governing interstate shipments and importations from abroad of wild birds and mammals.

### WILD ANIMAL PESTS

The widespread destruction by such stock and game killing animals as wolves, coyotes, mountain lions, and bobcats, as well as by the numerous crop, forage, and tree damaging rodents, including prairie dogs, ground squirrels, pocket gophers, rabbits, and others, especially in the Western States, has resulted in defensive organizations on a large scale to limit the losses from these sources. A constant, desultory warfare had been conducted against these animals by the payments of bounties and otherwise since early in the occupation of this continent by Europeans, and the lack of results from such sporadic efforts was amply demonstrated. As a result, during the past 10 years there has been a steady growth of correlation of Federal, State, and local efforts. Well-organized campaigns have resulted and have been vigorously conducted during the past year.

For the destruction of these wild-animal pests on the public domain and for cooperative work elsewhere during the year, an appropriation of \$447,666.42 was made by Congress. Of this sum, \$287,951.81 was used in the destruction of predatory animals and \$159,714.61 for the control of rodents. The work was conducted in 19 of the Western States and several Eastern States, which provided cooperative funds totaling \$894,922 either by direct State appropriations or from other sources. Approximately \$387,424 of the cooperative funds was expended for the destruction of predatory animals and \$507,498 in the rodent-control campaigns.

The general range of most of these animal pests has been determined. The fierce destructiveness of large wolves and of mountain lions, both to domestic animals and game, is so great that it becomes a necessity to eliminate them from certain areas. This, however, does not mean the actual destruction of these species, since they range over such a vast area in both North and South America that the possibility of their actual extermination undoubtedly lies many centuries in the future.

The coyote is one of the most widespread of all predatory animals and is so numerous in the aggregate that it is probably the most destructive of them all, both as to domestic stock and game. Enormous numbers of coyotes are killed each year, but they have so many young to the litter that, except in restricted areas, little more than the increase is destroyed annually. In parts of the West, however, the campaigns against them have materially reduced their numbers.

The effect of this reduction in the numbers of coyotes is well indicated by a marked decrease in losses of sheep and other livestock and by a very notable increase of game, including such ground-nesting birds as the quail. Coyotes are so cunning and adapt themselves so readily to changing conditions of environment, including the warfare against them by man, that they are showing as great persistence in maintaining themselves as the red fox, which still occurs in the eastern United States despite the centuries of pursuit by its human enemies.

The big wolves have been reduced to a relatively small number over much of the West. Since 1915 more than 5,400 of them are known to have been



killed, in addition to many which have been poisoned and not found. In northern Mexico, Canada, and Alaska these animals still occur in considerable numbers and will long persist as picturesque elements of the fauna. They will undoubtedly continue to invade the United States along the border for a long time in the future and only vigilant efforts will prevent them from reinfesting vast areas where the losses caused by them are now bringing about their destruction.

The numbers of both predatory animals and harmful rodents depend mainly on the food supply. The general distribution and abundance of livestock, together with widespread crop production, furnishes so dependable a food supply that, without organized control work, the aggregate losses from these pests would become appalling and successful stock growing and agriculture would become impossible over great areas.

The success of the long-continued educational work of the bureau to bring the public to a realization of the heavy annual losses from house rats and the possibility of eliminating most of them at a reasonable cost is becoming evident. Appeals for aid to control these pests have come from 45 States, and as much assistance as possible has been given with the men and funds available, and experts of the bureau have aided in organizing more or less extensive campaigns in 22 States.

The hearty cooperation of States, local organizations, and individuals has made possible the systematically conducted operations under the leadership of bureau representatives for the control of the various destructive animals. In addition to the funds contributed, more than 66,000 farmers and stockmen took active personal part in the rodent field work, contributing time and labor in operations on Federal and State lands as well as on their own holdings. Thousands of farmers and stockmen joined in the organized work of trapping and poisoning coyotes, and this has added greatly to its scope and effectiveness and made it possible to conduct operations at a minimum cost to the public.

#### PREDATORY ANIMALS

Field work against predatory animals was conducted during the year in Arizona, Arkansas, California, Colorado, Idaho, Michigan, Missouri, Montana, Nevada, New Mexico, Oklahoma, Oregon, South Dakota, Texas,

Utah, Washington, and Wyoming in cooperation with organizations and individuals. State agencies participating included departments of agriculture, livestock commissions or boards, game commissions, extension departments, county organizations, and stockmen's and farmers' associations. Cooperating Federal agencies that control areas of Federal lands included the Forest Service of the Department of Agriculture and the Office of Indian Affairs and the National Park Service of the Department of the Interior. The Bureau of Plant Industry and the Bureau of Chemistry of this department also have aided in consultations and laboratory investigations, and the survey field men have effectively cooperated in operations of the Bureau of Animal Industry to eradicate foot-and-mouth disease in California, which is not only destructive to domestic stock but also is a menace to deer and other hoofed game.

In addition to the thousands of cooperating stockmen a force of 406 trappers and poisoners was employed under bureau supervision during the year. Part of the men employed were paid from Federal funds and part by the States and other cooperating agencies. Skins or scalps of 38,591 predatory animals were taken, of which 562 were wolves, 34,092 coyotes, 3,507 bobcats and Canada lynxes, 237 mountain lions, and 193 bears. In addition to these animals, it is estimated that about 100,000 coyotes were killed in the extended poisoning operations, of which neither skins nor scalps were taken. Bears are regarded as game animals, and the official hunters have strict instructions not to kill them except individuals known to be destructive to livestock.

State game departments and sportsmen's associations in many States have cooperated heartily in the predatory animal work on account of its very evident favorable influence on the game supply.

**Wolves.**—When the organized work against predatory animals was started in 1915, wolves were regarded by cattlemen and other experienced observers as the wild animal by far the most destructive to livestock. Wolves had previously subsisted on buffalo, elk, deer, and other large game animals which they were able to pull down individually or by operating in packs. The development of the livestock business throughout the West afforded them an abundance of readily obtainable food among the calves, yearlings,

and even adult cattle, sheep, swine, and other domestic animals. Despite enormous sums paid in bounties on predatory animals, which sometimes almost bankrupted counties, and the great but unorganized efforts of ranchmen and their employees and of professional trappers, wolves maintained themselves in large numbers and exacted a heavy toll from the livestock industry. In some districts they rendered impossible the growing of sheep and hogs. Economic pressure due to restricted ranges and the necessity for closer attention to every item that reduced the margin of profit finally made intolerable this drain upon the possible output of livestock.

Inauguration by the Biological Survey of carefully planned organized operations and constant improvement of methods through investigations conducted by trained experts have made possible effective headway toward the extermination of these exceedingly destructive animals in livestock-producing areas. Concentrated efforts have been made to take promptly the more notoriously destructive individuals. Already 5,478 wolves have been destroyed and their skins or scalps secured. Many others are known to have been killed by poison, and in addition, numbers of pups and unborn young have been accounted for. In many sections where wolves formerly occurred in packs of 12 to 15, not a sign of a wolf has been seen during the past two or three years. These animals have disappeared from their well-known ranges following the placing of poison about their haunts, and have become so scarce that in a number of instances solitary wolves have been detected trying to lure dogs away from ranches as mates. This is not infrequently successful, and the hybrid young resulting often prove to be notoriously destructive animals.

One female wolf in Arizona that had been endeavoring to lure away a ranch dog was killed within 30 yards of the door of the ranch house through poisoned baits. Few young wolves have been permitted to escape during the past two or three years, and the adults that now remain are, for the most part, wily individuals that have thus far evaded capture by exercising extraordinary cunning. Throughout most of the western range country the losses from wolves should be practically eliminated in the near future.

The wolves crossing the international boundary from Canada and Mexico into the United States present

an international problem that will be difficult to solve. Of the 22 wolves killed in Arizona during the past year, 17 had recently crossed from Mexico. Of 39 wolves killed in New Mexico, 19 were taken by one hunter close to the Mexican border. This hunter, after returning to a locality which had previously been cleared of wolves, in two days found 14 calves killed and 21 mutilated by wolves which had crossed the border. Some cooperation has already been secured from American ranchmen in Mexico. They have worked in consultation with our leaders in border States and report having taken 70 wolves during the past two years.

Notable kills during the year include an old white wolf in Arizona, known for the past eight years on the Aguila range and reported by stockmen to have killed about \$25,000 worth of cattle and sheep in that time. On one occasion this wolf was definitely known to have killed 65 sheep in one night and 40 in another. It averaged a calf about every four nights. Coyotes had learned to follow this old wolf, sometimes as many as 12 or 15 at a time, in order to feast on the leavings after it had made a kill. Stockmen had placed a bounty of \$500 on its scalp, and many private hunters and trappers had worked for it months at a time without results. Its range was most unusual for a wolf, being in the low, hot desert at an altitude of not more than 3,000 feet above sea level and in a district overgrown with the typical desert vegetation, such as palo verdes and mesquites. This wolf succumbed in October to skillfully placed poisoned bait distributed by one of the cooperative Federal-State hunters.

A wolf locally known by forest rangers and stockmen as the "butchering wolf" was trapped in Eagle County, Colo., during July, 1923. In addition to its record of animals killed outright it had an unusual reputation for biting off the ears and tails or otherwise mutilating young calves and even full-grown cattle. The hunter who was detailed to the task of getting this renegade rode thoroughly over the country, noting signs where the animal ranged, and then carefully placed his traps. On his first visit to these traps he found the wolf awaiting him in one of them. The head of this wolf was mounted and now adorns the office of the State Board of Stock Inspection Commissioners in Denver, this board being the cooperating agency in Colorado.



A notorious she wolf was taken in December south of Pueblo, Colo., which had been known for a long time in that section and was responsible for the killing of many cattle. The hunter rode the range frequented by this wolf and succeeded in killing it within three weeks. It had been in traps several times previously, but had escaped, losing a toe on each front foot. The wounds had healed so completely as to give the appearance of a naturally three-toed animal. The manager of the ranch on which this wolf was taken writes:

I am taking this means to thank you for the services of your hunter in this neighborhood for the last two months. While there may be a few coyotes left, he has reduced them greatly in number, and it is a great satisfaction to know that we are rid of probably the last wolf in this part of the country.

A hunter north of Fruita, Colo., finally succeeded in December in trapping an old wolf with seven unborn young. It had preyed heavily on deer, cattle, and sheep in the section, and its dens had yielded the trappers a total of 21 pups in three consecutive years.

In one locality along the Oklahoma-Arkansas border, where no predatory-animal work had previously been done, 14 wolves were killed within a few days during October on an area less than 10 miles square, 11 being poisoned and 3 trapped. These wolves appeared to have a rather extensive range, and their depredations were heavy on calves, colts, and hogs, especially hogs, practically all of which had been destroyed by them in several neighborhoods in both States.

In southwestern Missouri 93 wolves were killed during the year the work has been in progress. In northern Michigan, where the work has been in progress for three years and where wolves have been very materially reduced in numbers, a hunter discovered signs that a small pack of wolves had recently passed. Four traps were set close together, and the following morning the trapper was rewarded by finding an adult wolf in each.

**Coyotes.**—At present coyotes, which in the aggregate in the United States must number several million animals, are unquestionably the most destructive predatory animals in this country. One of the most difficult problems of predatory animal control is raised by them. They are widely distributed and well endowed by their mental qualifications to protect themselves and secure food under a great variety of conditions. To insure their

perpetuation they are prolific breeders, sometimes having 14 young in a litter. Contrary to their former habits, coyotes may now be found throughout high and rugged mountain ranges and in dense forests.

Not only have they occupied practically all the available territory in the Western States, but they have moved northward into Alaska and to the delta of the Mackenzie River in Canada. They have successfully maintained themselves in such States as Illinois, Indiana, and Michigan, and continually invade new territory.

Coyotes persistently follow livestock and game in their seasonal movements between summer and winter ranges, constantly preying upon the young and even adult cattle, sheep, goats, and swine, and deer and antelope. Coyotes are also notorious destroyers of the eggs and young of ground-nesting birds, including such important species as sage hens, prairie chickens, quail, grouse, and many kinds of ducks. They also destroy great numbers of full-grown birds and are probably the most seriously destructive enemy of our game resources. Because of their foxlike skill in concealing themselves and in escaping pursuit, they often successfully locate their dens and rear their young in close proximity to ranches and farms. A recent study of denning activities in a limited area surrounding a single ranch revealed a group of 8 coyote dens, from which 48 pups were taken.

It has long been recognized by the Biological Survey that the only hope of coping successfully with these animals is through the development of effective poisoning procedure and its application on a wide scale throughout their range. With this in view, constant effort has been made to devise poisoning materials that would prove palatable and not arouse the suspicion of these alert animals and to devise methods of distributing poisoned baits in such a way that the infested area might be systematically covered.

Successful plans of organization and vigorous prosecution of the campaigns, including the use of these improved methods of poisoning, supplemented by a limited amount of trapping, shooting, and den hunting, have made remarkable progress possible in the control of these animals during the past year. The total number of coyotes killed and their scalps secured was 34,092, but animals actually found is not a measure of the number destroyed in poisoning campaigns. Skilled men are now employed during



six to nine months or more of the year working in cooperation with stockmen's associations and other local organizations in the systematic prosecution of the poisoning work. They spend practically their entire time in establishing poison stations, distributing baits, demonstrating methods to stockmen, and aiding them to establish and maintain effective poison lines. Relatively little time is now spent in searching for animals killed, as the value of the skins collected commonly would not pay for the time lost. This procedure is strongly urged by stockmen, who have become fully convinced as to the effectiveness of the poisoning operations, and whose first concern is to have the poison distributed carefully and on the largest possible scale.

Effective poisoning operations are conducted in summer, especially about watering places, but the work is done chiefly from October to April. Careful study is made of coyote conditions by experienced men stationed in each of the States, and, so far as practicable, the campaigns are launched chiefly after the livestock leave the summer or winter ranges, in close cooperation with the stockmen using the range. By systematically placing feeding stations and poisoned baits, and by posting notices and otherwise notifying the residents of the district, valuable dogs or other animals are protected. In settled country or other places where such action is desirable extended lines of feeding stations are often established and maintained until the coyotes become accustomed to feeding at them, and then small, specially prepared poisoned baits are placed, and a short, intensive campaign carried on, often resulting in the destruction of practically all the coyotes in the territory. Any poisoned material left uneaten is then picked up and destroyed or used elsewhere. Livestock losses over large areas have been practically ended by systematic work on summer and winter ranges and on lambing grounds. The total area covered in this work during the past year has been much greater than in any preceding year.

During the year more than 3,567,000 especially prepared poisoned baits were methodically put out in accordance with definite plans, and these poisoning operations covered an area of about 284,400 square miles.

One hunter and a cooperating stockman established a line of poison stations in Oregon, and the first time they returned over it found 29 dead

coyotes. A ranchman in Texas reports finding 57 dead coyotes along part of a 100-mile poison line which he established in accordance with directions given him. A rancher in Arizona reports that his men found 140 coyotes which they had poisoned by following instructions and, although coyotes had been abundant formerly, little trouble was experienced after using the poison. Another cooperator and his herder maintained a poison line in Oregon during the winter and picked up 87 dead coyotes. This practically rid his range of coyotes before spring.

Over great areas of range the destruction of coyotes has been so thorough that stockmen have been able to reduce the number of men required to handle their flocks. Many stockmen now report carrying their flocks through the lambing period with absolutely no losses from coyotes in localities where previously they were heavy. In addition to the direct saving of lambs, growing stock, and breeding animals, stockmen by this service can handle their herds at less expense and utilize the pasture more fully. Freedom of the range from predatory animals eliminates the need for long drives to bedding grounds and permits the use of the open-herding system, which is beneficial both to the sheep and to the range. Similar savings accrue also to producers of other kinds of livestock and of poultry. The destructiveness of coyotes to sheep was emphasized in a poster issued during the year for cooperative work in South Dakota (No. Bi-701), the chief feature of which was the direct question, "Why feed coyotes?"

Poultry production is becoming an increasingly extensive business in large parts of the country now occupied by coyotes, and with the destruction of these pests it can be developed on a more profitable scale. Their destruction has greatly benefited cattlemen also, as it has become evident that coyotes are exceedingly destructive to calves on farms and ranges, often materially reducing the calf crop and thus cutting down at a vital point the possibility of profitable livestock production.

In California, where an outbreak of foot-and-mouth disease resulted in great losses of livestock, Biological Survey representatives cooperated effectively with the Bureau of Animal Industry by conducting poisoning operations to eliminate coyotes or other possible carriers of the disease, and

so planned and organized the work that experienced men could be placed promptly in any locality where the disease might make its appearance or where this work would afford added protection against its spread.

In addition to beneficial results of this work accruing to the livestock industry, for which it is primarily conducted, the benefits to game resulting from coyote eradication have been very marked. In areas where coyotes have been destroyed, deer and antelope are reported to have raised a much larger proportion of the fawns than was known in recent years, and a marked increase of quail, grouse, and other ground-nesting game birds has been reported from many points in the West where the poisoning campaigns have been conducted.

**Mountain lions** still occur in numbers throughout much of the mountainous country in the West and are chiefly destructive to colts, calves, and sheep among domestic animals and to deer, elk, mountain sheep, and mountain goats among the larger game animals. During the year 237 mountain lions were killed by employees and coöperators of the Biological Survey in the Rocky Mountains and Pacific Coast States, making a total of 1,236 mountain lions killed since this work was organized in 1915.

Individually these animals range over great areas, apparently making more or less regular rounds in pursuit of their prey, and are hunted eagerly by sportsmen. The animals killed in this way, coupled with the work done in the organized campaigns, has led to a marked reduction in their numbers. At present the distribution of mountain lions is somewhat local, only a few usually occurring in a given locality. They are ordinarily hunted with dogs and rifle, but at times are successfully trapped and poisoned.

One herder in Arizona, after having 80 sheep killed one night by a mountain lion, put out poison according to instructions and the following day found the offender dead. Two private hunters in Arizona were instructed in methods of poisoning mountain lions and later reported killing 14 of them during the winter. One of the regular hunters in Arizona killed 15 during February following a heavy snowstorm which had driven the animals down out of their usual range into an area that had previously been practically cleared of them.

In the State of Washington 11 adult mountain lions were killed, among which were 3 that had nearly ex-

terminated the mountain goats in Mount Rainier National Park. During March a lion hunter in Colorado succeeded in killing a large male in the Pike National Forest just inside the Denver Mountain Parks Game Refuge. He had previously trailed this lion during December, but it made its escape after killing his leading dog. While trailing it in the Tarryall Mountains the hunter found that it had made serious inroads on the mountain sheep of this section, and while tracking it in the Denver Parks Game Refuge he found two deer which it had killed but a short time before. Another mountain lion, killed in Colorado in April, had recently killed a fine five-point buck.

One of the experienced hunters in Montana made a snowshoe trip of 400 miles and only secured 1 adult lion where two years before he took 23. In another section of western Montana where one of the bureau hunters caught several mountain lions two years ago, two men who knew the country well were only able to take two of them during the past winter, and the evidence indicated that but few are left in this section, although formerly it was heavily infested. Larger herds of deer have been reported in these localities recently than for years, a fact which sportsmen attribute mainly to the destruction of the mountain lions. Relatively few of these animals now occur in sections where livestock is being produced, and their control can be effected readily through the assignment of skilled hunters as conditions require.

Oil of catnip, the first use of which as a bait was mentioned in the report of last year, continued to be used effectively by hunters trapping mountain lions and bobcats, and arrangements have been made to obtain an additional supply from this year's crop.

**Bobcats and lynxes.**—During the year 3,448 bobcats and 59 Canada lynxes were taken by our official hunters. Bobcats occur in considerable numbers throughout the mountainous sections of the West, while lynxes are confined to the more northern regions and the higher mountains. Both feed to a large extent upon rabbits and other rodents, but are often exceedingly destructive to sheep, goats, antelopes, pigs, calves, and poultry. In certain parts of Arkansas, where bobcats are common, their destructiveness makes hog raising impracticable. Many deer, especially the fawns, and wild turkeys, quail, and other ground-nesting birds



are destroyed by them. They are taken readily by the use of trained dogs and are easily trapped. The use of oil of catnip has proved to be a particularly effective bait. Some hunters report that they have succeeded in taking every bobcat that came into the vicinity of traps baited with catnip oil. Bobcats are far less successful than coyotes in maintaining themselves in the face of civilization and rarely, if ever, regain territory from which they have once been eradicated. They are eagerly hunted by private hunters for sport and for the value of their furs.

**Bears.**—The hunters of the Biological Survey are instructed to consider bears as game animals and not to kill them except in cases where they are known to be destructive to livestock or where, in cooperation with State game departments, they are to be killed because of their destructiveness to game. They are protected by the game laws of practically all the Western States. Large numbers are killed by sportsmen during the open season, and this ordinarily serves to keep them well under control. In some localities the animals are reported as becoming overabundant and at times are excessively destructive to livestock, especially when there is a shortage of their natural food. Individuals, particularly grizzly bears, also become addicted to such killing and then it is necessary to destroy them as predatory animals. In the 17 States in which predatory animal work was conducted 193 bears were killed by official hunters during the year.

One notable kill was made in the Okanogan Forest Reserve in Washington. This bear, a grizzly, had been responsible for heavy losses during the past three years, and was definitely known to have killed 35 head of cattle and 150 head of sheep during the summer of 1923. The latter part of July it appeared near a camp after dusk and attacked a 4-year-old steer. Hearing the noise, the camp foreman investigated and found the grizzly holding the steer with its forefeet and biting at its neck. A shot failed to take effect and the bear ran away. At the request of livestock owners, an experienced hunter with trained dogs was assigned to the task and effected the capture of this notorious animal in about three weeks. This bear weighed over 1,100 pounds.

The utmost care is exercised to avoid killing bears through mistaken identity as to the culprit responsible for livestock losses. The following

case illustrates the careful discrimination exercised by our hunters: A report that a bear was killing sheep in Nevada near Lake Tahoe was personally investigated by the inspector. It was found that 15 sheep had been killed and tracks showed where a bear had been eating from the carcasses. Close inspection, however, showed where a large coyote had dug his claws into the ground in making a turn to catch one of the sheep. Further investigation showed places where a coyote had been sitting and had made short runs to the various places where the kills had been made. Acting on this evidence as to the animal responsible for the killing, poisoned baits were distributed along a trail traveled by the coyote, and the herder reports no further losses "from bears" during the season.

#### RABIES

In Washington, Oregon, northern California, Nevada, Utah, and Idaho rabies was of widespread local occurrence for several years among coyotes and bobcats and has resulted in heavy losses of livestock and the biting of many people. The measures employed have brought it so fully under control that only occasional outbreaks were reported during the year. Whenever an outbreak was reported experienced hunters were concentrated and promptly destroyed the wild animal carriers of the disease and the spread of the disease was quickly checked. In Washington two serious outbreaks occurred, but prompt and effective cooperation between Federal and State officials ultimately controlled the situation.

Similarly effective cooperation in cases where rabies made its appearance among domestic animals in Arizona and New Mexico, and the prompt destruction of coyotes and other possible wild carriers in zones surrounding the points where the disease appeared, made it possible to prevent its spread.

A most serious situation developed in Colorado, where apparently the disease was introduced on the San Isabelle Forest by a rabid dog. The case was not reported for several months, and a large number of cattle and other domestic animals were bitten and died. Five people also were bitten and promptly took the Pasteur treatment. One of these was bitten by a bobcat, two by coyotes, and two by dogs. Responding to the emergency thus created, the bureau made a spe-



cial detail of men to conduct a vigorous poisoning campaign against possible wild carriers in this district with the cooperation of stockmen and local officials. Large numbers of coyotes were killed in the poisoning campaign, as many as 16 being found at a single poisoning station. As a result, the range was thoroughly freed from coyotes and bobcats and the disease effectively controlled.

Rabies later appeared among dogs and coyotes on the eastern edge of the San Luis Valley in Colorado and spread rapidly. When the disease was reported to the Denver office prompt action was taken. The evidence indicated that it had been brought in by rabid coyotes or dogs which had crossed the Sangre de Christo divide in the vicinity of Pass Creek. A meeting of representative citizens was held and the San Luis Valley Anti-Rabies Association was formed and presented the situation to the county commissioners of six counties. County funds were promptly appropriated to cooperate with the bureau and the State board of stock inspection commissioners for carrying on a thorough eradication campaign against worthless dogs and coyotes and other predatory animals that might serve as carriers. Regulations regarding the muzzling of dogs and cats also were enforced. Ten hunters were placed in the territory under the immediate supervision of a field assistant, and at the close of the year the situation was well in hand. Occasional outbreaks may be expected, however, and effort must be continued to prevent further spread of the disease. Without such prompt control measures rabies might spread over the entire West, with appalling results.

#### RODENT PESTS

Steady progress has been made in the control of those rodents which have persisted and, in many instances, increased excessively in the face of ordinary agricultural and stock-raising conditions. Because of their numbers and widespread distribution they cause heavy losses of farm crops and forage grasses, also in orchards, vineyards, truck farms, and nurseries.

Investigations by the Biological Survey have determined successful methods of reducing the number of rodent pests, and plans have been devised for large-scale organization of systematic field operations to this end. Federal, State, and local agencies are so correlated that the work of clear-

ing great areas can be conducted in an orderly way. The work has been supported consistently by farmers and stockmen, as the direct benefits evident from it appeal to their business judgment. Large-scale operations have been greatly facilitated through the hearty cooperation of the Office of Cooperative Extension Work and the State extension service organizations, including the county agricultural agents and State and county farm bureaus. A poster (No. Bi-761), issued for use in the cooperative work with the Wyoming Extension Service, was helpful in drawing attention to the enormous losses caused by rodent pests in the State and to the comparatively simple method of deriving profits through increased stock production on areas where losses are suffered from range-destroying rodents. State departments of agriculture, county commissioners, and many agricultural, horticultural, and livestock organizations have taken an increasingly active part in the undertaking, and officials of the Forest Service, the Office of Indian Affairs, and the Reclamation Service cooperated most helpfully on their lands. The bureau continued to cooperate with the United States Public Health Service of the Treasury Department, and with State, county, and municipal health organizations in lines of work where rodents are important agencies in the dissemination of such diseases as bubonic and pneumonic plague, Rocky Mountain spotted fever, and tularaemia.

**Prairie dogs and ground squirrels.**—From the earliest settlement of the mid-West and the Western States the ground-squirrel and prairie-dog problems have confronted the farmer and stockman. Production of farm crops made conditions all the more favorable for constant increase in the numbers of these pests through the provision of a nutritious and readily available food supply. Especially in dry weather, when their natural food is scarce, these animals congregate on the cultivated areas, dig up the planted seeds, and sometimes the roots of the plants, and feed upon growing or harvested crops. They make serious inroads into grain fields and often completely devastate large areas. So long as there was an abundance of free pasturage little heed was given to the destructiveness of these animals to forage grasses. With the more complete occupation of the land by flocks and herds, and a growing necessity for giving greater attention to management details in order to ob-

tain a profit, there has developed a more persistent demand for eliminating the competition from these pests.

Prairie dogs often completely denude productive grazing lands of all the valuable forage grasses. It is common for prairie dogs and ground squirrels to reduce the forage available for livestock from 25 to 50 per cent. By selecting the more fertile lands their competition with livestock is rendered especially serious, because they feed upon the same nutritious grasses that are most sought by livestock. Occurrence of such animals in large numbers results in a marked decrease in the numbers of livestock that can be maintained on a given area. Their presence also interferes with the success of deferred grazing or grazing rotation practices, as they continue to feed upon the grasses during the period that stock are kept off and, finding such areas more favorable for their feeding, increase in numbers and destructiveness.

Campaigns organized to combat prairie dogs and ground squirrels during the past year covered 8,000,000 acres of Federal and private lands, which were given a first treatment with poisoned baits, and follow-up work with poison or fumigants on previously treated areas was done on 6,000,000 acres. This makes approximately 12,000,000 acres of Federal and 105,000,000 acres of State and private lands on which a large percentage of these pests have been poisoned since 1916 in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming. The Biological Survey and cooperating Federal agencies assume the cost of operations on the Federal lands. Owners of adjacent lands, however, continue to contribute much of the labor required to distribute the poison, and furnish much of the grain used as bait, in order to cover the largest possible acreage with the limited Federal funds and thus reduce the numbers of the animals migrating from the Federal to the adjacent private lands. State officials and county commissioners have provided for work on State lands, and farmers and stockmen have borne the cost on their own holdings.

Except in California, where the occurrence of the foot-and-mouth disease prevented the usual progress of field operations during the spring, there has been a steady advance in the work accomplished. A total

of 833 tons of poisoned grain was prepared and distributed under the supervision of bureau representatives and cooperating State and county officials, and 100,000 pounds of carbon bisulphide and 175,000 pounds of calcium cyanide were used in fumigating burrows to complete the eradication of rodents. Farmers and stockmen who took an active part in clearing their own lands, and in many instances aided on Federal lands, numbered 66,000.

It is estimated that a saving of more than \$4,000,000 was accomplished during the year, bringing the total estimated saving of crops and forage since this work was started on a large scale in 1916 up to \$72,000,000.

Many counties have adopted the plans proposed by the Biological Survey for coping with prairie dogs, and 11 counties in three States are reported as being free from them. Many others are from 95 to 98 per cent cleared, and other large units have adopted the plan of an intensive three-year campaign for the extermination of these rodents. From 75 to 95 per cent of the prairie dogs or ground squirrels are usually destroyed by the first poisoning treatment. Getting all the remaining survivors at times proves a difficult undertaking, but the work is being pushed with determination, and poisoning is being followed up with the use of carbon bisulphide and other fumigants. Marked improvement is reported in forage production on grazing areas which have been cleared.

The bureau has continued to arrange for the purchase of poison supplies in large quantities for use in the campaigns, and this has greatly reduced the cost to cooperators. Efforts have been continued to correlate work in each State with that in adjacent States in order to prevent reinfestation by migration. Where it has been impracticable with funds available completely to eradicate these rodents from Federal lands, effort has been made to correlate the work with that of adjacent landowners so as to afford them the most complete protection possible and at the same time to increase the productivity of the Federal lands. With the clearing of increasingly large areas of private lands there is a constantly growing demand upon the bureau to clear the pests from Federal lands so as to eliminate them from their breeding grounds. Stockmen who are leasing parts of Federal lands also urge the importance of eradicating the rodents as one



of the most direct and practical means of range improvement.

**Pocket gophers.**—The damage which pocket gophers do in orchards, vineyards, and alfalfa fields, and to truck crops, and demonstration that their control is practicable, have increased the efforts made to destroy them in Arizona, California, Colorado, Idaho, Kansas, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. Skepticism as to the possibility of eradicating these ground-burrowing rodents at a reasonable cost is being eliminated with success attending trapping and poisoning demonstrations.

One rancher in Colorado used traps and caught 240 pocket gophers in his native-grass meadow and now has it practically free of them. He keeps traps constantly about the field for use whenever one of the animals invades his land. A farmer in North Dakota completely eradicated pocket gophers from 160 acres of alfalfa by poisoning. Citrus growers and farmers in five counties in Arizona waged an effective campaign against these animals, and the three railroad systems within this territory cooperated by poisoning them on their rights of way. In Idaho four counties used 1,280 quarts of bait on 46,000 acres, getting about 80 per cent of the animals with the first treatment, and 35,000 acres that were given a second treatment showed about 95 per cent kill. In Washington much work was done in orchard sections.

A number of demonstration farms have been used where areas are cleared of the pocket gophers and where farmers of the vicinity learn the methods employed and see the benefits resulting from eradication of these pests. Such demonstrations are leading many farmers to undertake to clear their land. In South Dakota many alfalfa fields had to be plowed up and planted to corn on account of the damage done by pocket gophers. As the acreage of alfalfa is being enlarged in this State, there is a marked increase in the demand for destroying these animals. In certain parts of Kansas pocket gophers showed such marked increase during the year that efforts for their control have been undertaken with renewed energy. Two counties have undertaken the work as major projects and this work is in progress in practically all of the eastern and central counties of the State. Trapping and poisoning the animals and leveling the mounds have resulted in marked benefit to the al-

falfa crops and have eliminated much annoyance and loss due to damage to machinery during harvest. Trapping and poisoning have been continued along the banks of irrigation ditches to prevent the breaking of the banks through pocket-gopher burrows. One of the most extensive tasks of this kind has been accomplished at the Elephant Butte irrigation system in southern New Mexico.

An appeal was recently received from the commanding officer of the United States naval air station at San Diego, Calif., for assistance in ridding the landing fields of both the Navy and Army air stations from the pocket gophers which infested them. Not only were the animals undermining the fields and causing serious accidents to the landing planes and endangering the flyers but they were also destroying lawns and gardens. About 1,500 acres were involved on this island. An assistant was detailed to take charge of the eradication operations, the bureau furnishing the necessary poisons and traps, while the air-station officials furnished labor and other materials. After application of the poison, a steam roller was used to level all the mounds and thereby make it easier to locate any new ones that might appear. As a result, the station was practically cleared of pocket gophers, and the work is being followed up with a view to coping promptly with any further animals that may put in an appearance.

**Jack rabbits and cottontails.**—There was great variability in the abundance and destructiveness of jack rabbits during the year. Efforts for their control were conducted in Arizona, Idaho, Kansas, North Dakota, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming.

In localities where the animals were doing serious damage, effective control work was accomplished through poisoning operations and the organization of drives. Cooperative drives in Colorado netted 20,000 rabbits, which were shipped free by cooperating railroads for distribution in Denver to charitable organizations. Two drives covering two and one-half townships in Kansas netted 10,000 rabbits. Jack rabbits are reported generally on the increase in that State. They are also reported on the increase in many parts of North Dakota, where two drives resulted in the killing of 13,000. Drought in Oregon during the spring of 1924 caused rabbits to congregate from wild lands into cultivated areas, where they caused considerable de-



struction of growing crops. Approximately 50,000 of these animals were killed by poisoning operations in Morrow County alone. In Texas 12 drives yielded about 25,000 jack rabbits. In Utah 340,500 were reported killed on 128,220 acres by poisoning operations, in which 536 ranchers participated.

The following note received from the Forest Service in reference to snowshoe rabbits in Minnesota is of interest:

The snowshoe rabbit is the one principal factor in the loss of a considerable number of planted trees in the forest plantations of northern Minnesota. The abundance of rabbits this year and the damage they are doing are evident to the most casual observer who visits the cut-over areas of the region where both State and Federal authorities are endeavoring to make denuded forest land again productive through extensive planting of young pine seedlings. Not only are the tips and needles of planted trees eaten by the rodents, but much of the natural young growth of pine, spruce, aspen, and maple is cut back and defoliated or barked near the base if the trees are over 3 feet high. Of the three principal species planted—white pine, Norway pine, and white spruce—the damage is heaviest in the white pine and least in the spruce. All three, however, are so heavily damaged as to cause death in the case of any of the trees whose tips can be reached above the surface of the snow by the rabbits. It is reported that 79 per cent of the trees in one plantation were eaten off by the rabbits, 43 per cent fatally. In another instance practically the whole plantation of white pine was destroyed by the rabbits.

Reports of damage in orchards by cottontails were received from many sections throughout the country. The use of protective devices recommended by the bureau afforded a large measure of relief. These animals are usually regarded as game and are ordinarily kept in reasonable numbers by hunters, but they have increased considerably in a number of regions. At the close of the year a publication was in press on the distribution of the European hare in North America (*Journal of Agricultural Research*).

**Woodchucks.**—Heretofore complaints of damage by woodchucks have come more largely from the Northwestern States, where these animals live in rim-rock formation, from which they invade neighboring vegetable gardens, truck farms, and alfalfa fields and do extensive damage. More recently the seriousness of the damage done by woodchucks in the Northeastern and mid-Western States has become evident, and they appear to be increasing rapidly in many sections. They do extensive damage by making burrows in hillsides, which are often the beginning of serious erosion. Their excavations in the banks of levees often permit

water to run through in times of high water, breaking the levee, flooding large areas of adjacent farm land, and destroying crops. They also do extensive damage by feeding upon clover and other valuable forage plants and upon root and vegetable crops in truck farms and gardens.

Investigations were conducted and improved methods developed for fumigating burrows of woodchucks in the Eastern States. Carbon bisulphide and calcium cyanide were found effective for destroying them in their burrows. Campaigns of considerable extent were conducted in Morgan County, Ind., and Stark County, Ill., in which representatives of the bureau demonstrated methods and assisted in the organization of the campaigns. Farmers joined enthusiastically in this work, and very satisfactory results were obtained. In Idaho demonstrations were given and 13,500 acres of infested lands were treated with 2,700 pounds of poisoned bait. A number of demonstrations were given in other States where damage was reported, and much information on the control of these animals has been furnished through correspondence.

**Field mice.**—Educational work in bringing the seriousness of damage by meadow mice and pine mice to the attention of orchardists, truck farmers, and gardeners has led to a marked increase in the applications for control measures. Extended demonstrations have been given in many States showing orchardists how to distribute poison in such a way as to eradicate these pests before the season when damage is most likely to occur. These animals are so small and often increase to such inordinate numbers in a very short time that they cause serious damage before anyone is aware of the danger. Efforts have been made to induce orchardists to make mouse control a regular feature of their orchard management practices, since losses from this source some years run into millions of dollars. To assist in this work, *Farmers' Bulletin No. 1397, "Mouse Control in Field and Orchard,"* was issued in March.

In the Yakima Valley, Wash., where orchardists, following demonstrations and the organization of a campaign, were successful in destroying mice, and thus protecting their orchards in the face of a serious outbreak of these animals in 1922 and 1923, poisoning operations were again carried on actively as a means of insuring against a recurrence of losses. Work against mice in five of the more im-

portant orcharding counties covered 34,270 acres, and 853 orchardists co-operated, using 53,180 pounds of poisoned grain.

In Idaho 1,200 acres of orchard were treated with 1,296 pounds of poisoned grain. Local outbreaks of mice in Oregon were promptly controlled by poison. Field-mouse control demonstrations were arranged and conducted during the fall months in the important orcharding sections of Massachusetts, New Jersey, West Virginia, and Indiana.

**Cotton rats.**—In Arizona active work was done by the citrus growers against cotton rats, which had suddenly appeared in destructive numbers. One grower killed 408 of these rodents in a 6-acre grapefruit orchard. Another, by the use of a few cents' worth of poison killed two cotton rats, which, within a few nights in one nursery, had killed 1,000 young citrus trees worth more than \$1 each.

**Kangaroo rats.**—Extended investigations on the Jornada Range Reserve in New Mexico showed that kangaroo rats were causing a loss of forage amounting to an average of 5 per cent of the possible production. On 78,000 acres that were treated for the destruction of these animals the dens averaged more than 3 per acre, and in some parts of the area infestation ran as high as 18 dens per acre. About these dens the kangaroo rats had completely destroyed the grass in considerable areas. The dens of these animals are a source of annoyance and loss also, as cow ponies are frequently thrown when being ridden after stock. The cost of eradication by poisoning was less than 2 cents an acre. Stockmen of the vicinity watched the work with great interest and many have already expressed their desire to rid their ranches of these animals. They are willing to furnish all labor and grain if the Biological Survey can arrange to furnish sufficient supervisory direction to insure success.

**House rats and mice.**—House rats are of more universal concern to the people of the United States, from the Atlantic to the Pacific, than any other wild animal pest. They have long been recognized by experienced observers as the most destructive species of animal in the world and as one of the most dangerous from the standpoint of the transmission of communicable diseases. An abundance of food and plenty of shelter in cities, towns, and rural districts has enabled them to intrench themselves almost

everywhere that man has established his abode. Even the more arid sections of the country are being slowly invaded. In dry-farming areas they establish themselves about the home, barns, and poultry houses, where they carry on their usual nefarious activities.

The bureau has continued to furnish information regarding the destructiveness of house rats and mice and the danger to health from their presence. Practical methods for their control have been presented through publications, demonstrations, and the organization of control campaigns. Especially good progress has been made during the year in working out and applying detailed plans for the organization of community campaigns. Generally the county, including urban and rural districts, is the most practical unit for handling antirrat campaigns, as it is of sufficient size to permit the careful working out of all details essential to success. These campaigns have received the most gratifying support from the public press, county and municipal officials, business men, civic, social, and welfare clubs, and public-spirited citizens generally. In connection with their freight, express, warehouse, and dining-car service, railroad officials have cooperated actively with communities where rat-control work was undertaken. Increased interest is also being shown by hotels, restaurants, packing houses, markets, and other concerns engaged in preparing, storing, or providing food products for the use of the public.

With a view to the prompt control and ultimate elimination of the rat pest, emphasis has been placed on the importance of rat-proof construction or repair of buildings, closing basement windows, and all other openings which provide entrance for rats, promptly disposing of garbage and eliminating piles of trash and refuse where rats find food or shelter, poisoning rats wherever possible and systematically trapping them elsewhere, fumigating rat burrows with such poisonous gases as carbon bisulphide, calcium cyanide, or hydrocyanic-acid gas, using effective rat dogs, and organizing community killing drives.

Demonstrations in rat control have been given during the year in Arkansas, California, Colorado, Idaho, Illinois, Indiana, Kansas, Massachusetts, New Jersey, New Mexico, North Dakota, Oklahoma, Oregon, South Carolina, South Dakota, Texas, Utah, Washington, Wisconsin, and Wyoming.



General assistance has also been given through correspondence and supplying copies of Farmers' Bulletin No. 1302, "How to Get Rid of Rats," for which there has been a remarkable demand. The preparation and issuance of the moving picture entitled "The Modern Pied Piper" has met an important need for publicity material of this character, graphically presenting, as it does, the essential features involved in organizing and conducting effective warfare against rats. The demand for this film has been greater than it has been possible to meet. A poster (No. Bi-733) issued during the year, depicting rats as "vandals of the night," has also been of help in stimulating intolerance of this pest.

As illustrating the general character of the campaigns conducted, the following instances may be cited: At Little Rock, Ark., where rats had become an intolerable nuisance as a source of loss and a menace to health, a live committee of a local women's club appealed to the bureau for assistance in launching and carrying out a drive against the pests. Two specialists were assigned to aid in this work. Material calling attention to the importance of the campaign and plans for its conduct were disseminated by means of newspaper articles, circular letters, billboards, window cards, and illustrative slides at picture shows. When everything was in readiness, the drive itself was launched and in it 3,000 pounds of poisoned bait were distributed, sufficient to make 48,000 individual rat baits. These were distributed throughout the entire business district comprising approximately 100 city blocks, along the water front, on city dumps, and in other places where inspection had disclosed rat infestation. In this instance \$400 worth of prizes were offered for various points. As evidence of the effectiveness of the drive, 12,400 rat tails were turned in.

As only a very small proportion of the rats killed by poisoning with barium carbonate usually die outside their holes, where they may be found, this number will give some idea of the number actually destroyed by this campaign. In this instance, as is usually the case where antirrat campaigns are organized under the leadership of the bureau, the special rat drive led to results of more permanent character looking to improved economic and sanitary conditions. Ordinances were enacted, one providing for the rat-proofing of buildings and another requiring property owners to

clear away debris and clean up property following fires. Provision was made to stop the leasing of city property along the river front, with a view to making this into a city park instead of a rat harbor. The approximate cost of this campaign to the people of Little Rock was \$6,850, which covered prizes, poison, bait material, advertising, and considerable labor.

Important rat control operations also have been in progress in Portland, Oreg., in cooperation with the city health office. Without inaugurating a special drive, the work has been carried forward steadily along progressive lines. Information has been furnished business houses and the citizens generally regarding its importance and the practical means of accomplishing the desired results. Demonstrations have been given showing poisoning and trapping procedure and essential features in rat-proof construction or repair of buildings. Special attention has been given to the city markets, with most gratifying results in enlisting the cooperation and support of the business concerns. Buildings, docks, and warehouses to the number of 371 were inspected and methods suggested for making them more satisfactory from the standpoint of rat-proof construction; and 103 other buildings inspected were found to be in good condition. Supplies of poison, sufficient to meet requirements, were prepared and distributed; 927 pounds of poisoned bait have been placed on the city fills and dumps, which were previously badly infested with rats, and 425 pounds of calcium cyanide have been used on the city dumps and along the river banks. The work has progressed to a point where it is only a question of time and effort largely to eliminate losses from rats in this community.

Another important case is that of the Center Market in the city of Washington, D. C. When the Department of Agriculture took over the management of this great city market the place was found to be badly infested by rats. There was not only loss in food products but also danger to health through contamination of food, especially that to be eaten raw. So serious was the infestation that some who had noticed the conditions hesitated to purchase their food supplies there. Control measures were inaugurated quietly in order to clear up the situation and not unduly disturb the public. Barium carbonate was distributed under carefully controlled conditions, and 300 rats were found killed at one



time. Traps also were used on a large scale. Accumulated rubbish was cleared away, infested hollow walls and other structures were replaced by rat-proof construction, more sanitary and rat-proof booths were built of concrete, and a large incinerator was installed to consume garbage and other rubbish. Special attention was given to rat-proof food-storage places, including all cold storage. The interest of the dealers was enlisted in the effort, and many neighboring commission houses, at their request, were assisted and have adopted measures recommended for the protection of the food products which they handle. While the market is still subject to some invasion by rats from surrounding property and through introduction with shipments of food, necessitating follow-up work, conditions have been vastly improved, and from this standpoint the market is now one of the most satisfactory in the country. This has proved a valuable object lesson to other markets which have undertaken similar improvement.

In many parts of the country there has been much interest in the control of rats about poultry houses, because of their destructiveness to eggs and young chicks and of their serving as possible carriers of avian tuberculosis. The Biological Survey has given special attention to meeting the requirements of poultry producers by working out methods suited to their particular needs.

Investigations have been continued to improve methods of combating rats. In this the bureau has had the helpful cooperation of the Bureaus of Animal Industry, Chemistry, and Plant Industry, and the Hygienic Laboratory of the U. S. Public Health Service.

#### MOLES

The bureau has continued to demonstrate and furnish, through publications, practical methods for the control of moles where they are doing damage in lawns, gardens, truck farms, pastures, and hay meadows. Investigations also have been continued with a view to determining more simple and easily applied methods for the control of these animals.

#### EXHIBITS AT FAIRS

The economic work of the bureau has been represented in exhibits of the department at State and interstate fairs in Arizona, California, Colorado, Idaho, Kansas, Montana, Nevada, New

Mexico, North Dakota, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. The damage by rodent infestation to forage production on the ranges and methods of economically and effectively destroying these pests were thus graphically depicted, together with damage by predatory animals, with methods of control.

Mounted specimens of both rodents and predatory animals were made a part of the exhibit, a very interesting feature of which showed a bobcat destroying a lamb. Field men of the bureau cooperated in the exhibits by adding live specimens and other material to bring out local conditions. The attendance at these booths has been quite marked, and from the information given increased cooperation has resulted on the part of ranchers visiting the fairs.

#### FUR RESOURCES

Investigations of fur farming and the study of fur resources have so increased in importance during recent years as to make their establishment as a separate division of the Biological Survey generally advantageous. Arrangements to this end were completed during the year and, effective July 1, 1924, a new Division of Fur Resources will be created in the bureau, by separation of this line of work from the Division of Economic Investigations.

Investigations in connection with the production and conservation of fur-bearing animals have been carried on during the past year, and the progress made has been gratifying. The bureau has kept in close touch with fur farmers, raw fur buyers, dressers, dyers, manufacturers, and retailers. In compliance with requests it has aided in the formation of State fox breeders' associations, as well as encouraged the amalgamation of the American and the National Silver Fox Breeders' Associations. Encouragement also has been given to the movement for the registration of silver foxes and the formation of one national registration association, and satisfactory progress has been made along these lines. Support has been given to proposed legislation for the conservation of fur-bearing animals with a view to maintaining a permanent supply.

In response to requests assistance has been given to a number of States in revising existing laws and in drafting new ones for the protection and

propagation of fur animals. The active help of State game commissions, conservation societies, and the fur trade has been enlisted in conserving fur bearers in the wild, since the maintenance of a supply adequate to meet the requirements of the fur trade is of the utmost importance. An advanced step was taken at the President's Conference on Outdoor Recreation, held in Washington, D. C., in June, when those assembled went on record as favoring the formation of a permanent organization for the purpose of devoting considerable effort to the study of the problems of wild life conservation.

**Fur farming.**—Fur farming as a commendable adjunct to conservation in keeping up the supply of raw furs is being given encouragement by the bureau. It is estimated that approximately 1,200 fur farmers in the United States and Alaska are engaged in the production of one or more species of fur-bearing animals, the majority of them raising silver and blue foxes. The total investment in the business is somewhere between \$12,000,000 and \$15,000,000. By scientific investigations constant effort is being made to obtain information essential to the requirements of the growing industry. Fox ranches in the United States have been inspected for the purpose of studying methods used in breeding, feeding, and handling fur animals. A number of fox farms were visited in order to study outbreaks of contagious diseases and parasitic infestation in order that the bureau might be in better position to advise ranchers in their efforts to combat similar outbreaks.

The bureau has continued to promote sound education in fur farming and the conservation of fur bearers. With this object in view it has released through the press service of the department and published in various fur-trade journals numerous articles dealing with these subjects. A department bulletin on blue-fox production in Alaska has been nearly completed and, it is hoped, will be available for distribution shortly.

**Experimental fur farm.**—The most important work accomplished during the period covered by this report was the selection of a suitable location for the experimental fur farm and its removal from Keeseville to Saratoga County, N. Y. The new farm is equipped with modern buildings, pens, and dens, a small laboratory in which to study diseases and parasites, and a utility house divided into a storage room, carpenter shop, and feed room.

Experiments are being conducted at the fur farm with red, cross, and silver foxes, skunks, and martens. Records are kept of the quantities and kinds of feed required for fur bearers, to determine the effect certain feeds or combinations of feeds have on the animals and the furs produced, and the quantities which give best results under varying conditions. Studies and observations also are being made of the animals during the breeding, gestation, and whelping periods, to work out problems in genetics and handling practices.

Diseases and life histories of internal and external parasites have been studied for the purpose of determining methods of prevention and treatment. Important progress has been made in these studies and in determination of age and seasonal susceptibility of animals to infestation and their tendency to develop immunity toward such infestation, and experiments have been made with remedial agents for the removal of parasites. Improved methods of handling the animals during treatment have been devised and valuable data gathered regarding the tolerance of foxes to various drugs. The resulting information, which is essential to proper treatment at various ages and under different conditions of health and vigor, will shortly be published in the *Journal of Agricultural Research* under the title "Anthelmintic Efficiency of Carbon Tetrachlorid in the Treatment of Foxes." As a basis for clinical and diagnostic work, studies have been continued on various features of the physiology of fur bearers, including the pulse, respiration, and temperature.

The information obtained by experimental studies on the fur farm, together with observations made in the field, has been assembled in the form of letters and published articles and distributed free of charge to those requesting it. Prospective breeders, as well as those now engaged in fur farming, have derived benefit from the findings, and State agricultural colleges and experiment stations, State game commissions, and conservation societies have been rendered assistance in solving their problems.

The benefits derived from the work at the experimental fur farm do not end with the actual raising of animals in pens. The data obtained form a background of necessary information in connection with the formulation of trapping laws and in helping to establish the fur industry on a sound basis.



## FOOD HABITS RESEARCH

### MORTALITY AMONG WILD BIRDS

One of the most interesting occurrences of the year in connection with our work on migratory wild fowl was the apparently mysterious death of a large number of canvasback ducks in Chesapeake Bay, Md. During December and January dead birds were found at various points in the upper part of the bay, but particularly in the neighborhood of Spesutie Island. At the request of sportsmen and others who were perturbed by the occurrence the Biological Survey made an investigation and found that the ducks had died from phosphorus poisoning. The alimentary canals of all the dead birds were well filled with food, chiefly winter buds of wild celery, but this material was reeking with phosphorus, so much so that it smoked upon exposure to the air and produced a noticeable glow in darkness. Particles of phosphorus the size of small chicken feed were numerous in the food contents and upon drying in the air would readily ignite. It is difficult to understand how birds could continue to swallow so corrosive a substance as phosphorus until their whole alimentary canal was saturated with it, but swallow it they did, and death was of course inevitable.

The phosphorus was obtained while the birds were feeding in a wild celery bed, where grenades charged with the chemical had dropped during experimental firing from the Aberdeen Proving Ground. Remedial measures recommended by the Biological Survey were promptly adopted by officials of the War Department. At first a boat was moored over the bed to frighten the ducks away, but this being carried off by ice renewed mortality occurred. Another boat containing a human effigy was then installed, as well as an automatic firing device, with the result that no more birds visited the bed. Because of the size of the area involved and the thoroughness with which the phosphorus is distributed over it, radical measures to remove the menace entirely are impracticable. The phosphorized wild celery bed will probably remain dangerous to canvasbacks while natural processes, such as silting over of the bed and gradual dissipation of the phosphorus, are in progress. Meanwhile efforts to keep the birds away from this death trap will be continued.

Mortality among wild ducks in Louisiana occurred as usual toward the

end of the hunting season. An investigation revealed the number of birds affected to be not so large as reported, and the cause to be lead poisoning. This is a malady of ducks that may occur at favorite shooting grounds anywhere in the country, and the Biological Survey has previously published a bulletin (Department Bulletin 792) giving the history, causes, and symptoms of the trouble.

At the close of the fiscal year an investigation of alleged destruction of birds by poisoning operations in cotton fields was in progress.

### ECONOMIC STATUS OF LAUGHING GULLS

On islands along the eastern shore of Virginia are considerable colonies of laughing gulls. This species is a medium-sized gull, by no means so omnivorous in its feeding habits as the larger herring gull which occurs in that section in winter. Nevertheless, emphatic charges were made that the gulls were destroying clams, scallops, oysters, and crabs to such an extent as to constitute a menace to the fishing industries of the region. A thorough investigation of the matter showed that whatever basis there may be for the charges lies in the depredations of the winter or herring gulls, and that even these are scarcely serious. The summer, black-headed, or laughing gulls were found to eat no large shellfish, very few crabs other than the worthless fiddlers, and no fish of commercial value. These gulls also appeared to be guiltless of egg eating, a pernicious habit so characteristic of some of the larger gulls. Nests of terns, clapper rails, and of other birds observed in close proximity to those of the laughing gull were in no way molested. In fact, these gulls really protect the eggs of their smaller neighbors by driving away marauding fish crows. Nothing disclosed in this investigation of the laughing gull in Virginia warrants any change in the protected status of the bird.

### CONTROL OF DESTRUCTIVE BIRDS

In the annual report for last year mention was made of delay in issuance of a bulletin on magpies in order to permit inclusion of the results of further experiments in control of the birds. These were carried out the past winter in Colorado. A mild winter, with conditions rendering baits less attractive to the birds, hindered



the work somewhat, but fairly satisfactory results were obtained. Under the weather conditions encountered animal baits were found to be much more effective than vegetable. A method of exposing the baits to the birds, yet keeping them out of reach of dogs and other farm animals, was devised and gave good results.

Assistance was given to persons desiring to reduce the number of crows frequenting a large roost in south-central Indiana. In Louisiana reconnaissance was made of the area in which damage to rice by blackbirds occurs and a conference was held with interested persons. Only minor assistance could be extended in this case, as the handling of a general campaign against a bird destructive over most of the rice-growing area is beyond the present available resources of the Biological Survey.

#### **SURVEYS OF FEEDING GROUNDS OF GAME BIRDS**

The regular work included surveys of numerous lakes and marshes in Minnesota, Wisconsin, and Michigan used as feeding grounds by migratory game birds. Other work of the same general nature was carried on in Arkansas, Illinois, and Louisiana. In all cases reports on the surveys, together with recommendations for improvement in conditions, were made to interested individuals, officials, or organizations.

Especial attention was given during the year to obtaining data on drained areas. Reports indicate that some of the drainage operations have resulted unsatisfactorily so far as yielding lands suitable for agriculture is concerned. The Biological Survey is keenly interested in such matters, for the lakes and marshes are extremely valuable national assets from the viewpoint of recreation, not to speak of their importance in the original state as resorts for wild fowl and fur bearers. In this line of work the following drainage projects were inspected during the year: Mud, Thief, and Roseau Lakes, in Minnesota; the Horicon Marshes, in Wisconsin; and the Kankakee Marshes, in Indiana and Illinois.

A survey of the food resources for game birds was made also on Sapelo and Blackbeard Islands, off the coast of Georgia, and a report prepared recommending improvements. This is the locality where a cooperative introduction of Central American game birds is being made.

#### **EXAMINATION OF STOMACHS OF BIRDS**

In the course of the year the contents of 1,785 bird stomachs and of 209 owl pellets were examined. The groups most numerously represented by the stomach analyses were English sparrows, hawks, and shorebirds. As in former years, a number of special examinations were undertaken for correspondents of the bureau, the most noteworthy of which were of stomachs of woodpeckers, destructive to cacao in the Dominican Republic; hawks, from Arkansas and New York; owl pellets, from Pennsylvania; snow geese, from Quebec; black swifts, from the State of Washington; American mergansers and golden-eyes, the former guilty and the latter suspected of devouring trout in Michigan; and a miscellaneous collection of fruit-eating birds, chiefly robins and cedar waxwings, from Oregon.

#### **COOPERATIVE STUDY OF QUAIL**

In the region between Thomasville, Ga., and Tallahassee, Fla., are numerous large estates, the winter homes of sportsmen, among whom quail shooting is a leading recreation. Factors affecting the abundance of the birds have not been well understood, and this fact, together with a desire to maintain the maximum number of quail on the land, led to the contribution by groups of property owners, headed by W. S. Thompson, chairman of their committee, of a liberal fund available for three years, with which the Biological Survey could make a thorough investigation of the life history of the quail and of all factors affecting the abundance of the species. Two assistants have been employed for this work and a laboratory established at Beachton, Grady County, Ga., near the Florida line.

Numerous birds have been trapped and banded, so that information on the movements and longevity of individual quail will be obtained, as well as data on pairing habits, the make-up and permanency of coveys, and the like. A careful study is being made of the nesting of the quail, including character of site, range in number of eggs, destruction of nests by various agencies, and the net production. The relation of all natural enemies to quail will be specially studied, and emphasis will be placed also on food investigations, including possibilities of increasing the supply. Opportunity is afforded by the present investigation for making the most complete

study of life history that has ever been made of an American game bird, and numerous interesting and valuable results are confidently expected.

#### MISCELLANEOUS INVESTIGATIONS

An exhaustive study of the relations of the colony of white pelicans to fishes and the fishing industry at Pyramid Lake, Nev., had been under way a month and a half at the close of the fiscal year. It is being continued, and the bureau is confident that the data obtained will make clear what policy should be followed in regard to this much-criticized community of birds.

A trip of inspection of leading game farms was made to points in Illinois, Massachusetts, New York, and Pennsylvania with a view of learning the present status of the industry and of obtaining information and photographs for use in publications on the subject.

Tabulation was made of reports of game breeders holding permits for the propagation and sale of migratory wild fowl. This was based on about 90 per cent of the 1922 permits. There were 4,291 holders of permits, and they reared approximately 42,800 birds, of which about 12,200 were sold for propagating purposes and for decoys and 10,100 for food, while 8,000 were eaten at home.

A section on game poultry was contributed to an article for the 1924 Yearbook on poultry, and one on the relation of wild life to land values to an article on land policies in the 1923 Yearbook.

The manuscript for a new bird-house bulletin, entitled "Homes for Birds," was prepared for publication, as well as one relating to the economic status of a group of shorebirds—the woodcock, snipe, dowitcher, and knot. The manuscript of a bulletin on the magpie was revised. Two publications were issued during the year—Department Bulletin No. 1196, "Food and Economic Relations of North American Grebes," and Miscellaneous Circular No. 13, "Local Names of Migratory Game Birds," and at the end of the year a report was in press on the food habits of some winter-bird visitors (Department Bulletin No. 1249).

Concerning the laboratory work, it may be said that, as usual, the reference collections were built up to a higher standard of efficiency, and at the same time important transfers of material were made to the United States National Museum. Large numbers of notes on the food of birds have been extracted from periodicals

and from other sources, and the file of reference pamphlets has been considerably augmented.

Examination of the stomachs of mammals was continued in a minor way, 113, chiefly of shrews and moles, having been analyzed.

#### FOOD HABITS OF REPTILES AND AMPHIBIANS

The study of the economic relations of American toads was notably advanced during the year by the examination of 1,001 stomachs, representing 12 species. A few reptile stomachs were examined and incidental to the other work reports were made for correspondents and members of the Biological Survey on special collections of reptiles and amphibians from Alabama, Arizona, New Mexico, Guatemala, Honduras, Panama, and Colombia. Important additions were made to the files of information on the food habits, life histories, and nomenclature of reptiles and amphibians.

#### BIOLOGICAL INVESTIGATIONS

The technical scientific investigations of the bureau have continued throughout the year. A large number of specimens of birds and mammals have been submitted for comparison and identification by scientific or educational institutions and individuals from all parts of the country. In addition the bureau has received a large number of applications from other governmental departments or bureaus, State officials, scientific and educational institutions, and others for technical information on the wild bird, mammal, and other vertebrate life of North America, and many requests for information concerning species in various parts of the world. Although these demands require the time of specialists to furnish the necessary information, it is considered a highly desirable public service. In regard to all forms of wild life the Biological Survey is being looked upon more and more by the public, as well as the Government service, as a dependable source of information not only as to the technical characteristics of the various species but as to their habits, distribution, and economic relations.

The information files of the bureau now contain 1,500,000 cards in addition to a great mass of original manuscript matter on the birds, mammals, reptiles, and amphibians of North America, and with the great study collections of these vertebrates gathered during many years of field work.



they furnish an unequalled store of information available to the public. The information in these files has come from a variety of sources, and their value can scarcely be overestimated. Without them it would be impossible effectively to conduct the administration of the bureau.

The gradual growth of the study series of birds maintained by the bureau had exceeded the accommodations to a point that rendered its use for reference extremely difficult. As a consequence, the collection was completely rearranged, new cases supplied for expansion, and a card catalogue of it completed. The collection, which is constantly being referred to in the preparation of reports and in supplying information to correspondents, is now more readily accessible.

Among other services to the public during the year has been the supplying to associations and individuals of information concerning the distribution of game and other birds and the requirements essential to their maintenance and increase under the legal protection now accorded them.

#### TECHNICAL STUDIES OF MAMMALS

During the year work progressed well on a monograph of the ground squirrels of the genus *Citellus* and related genera. This is one of the groups which exist in such abundance over great areas in the western United States that they are among our most serious animal pests, destroying millions of dollars annually in crops and forage. In addition, they are known to be carriers of the bubonic plague. It is important, therefore, that we should have definite knowledge of the existing species of these animals and the distribution of each, since through such information they can be more intelligently controlled, in case of a serious outbreak of the plague or some other disease transmittable through them. It is obvious that a technical knowledge of the species of rodents and of their distribution and habits is of the utmost practical importance in view of the information we have obtained during the past few years of their very direct relationship to crop and other plant production, including reforestation.

There was in press at the end of the year a revision of the pikas (*Ochotona*) (North American Fauna No. 47), and a technical study of "Individual and Age Variation in *Microtus*

*montanus yosemite*" (Journal of Agricultural Research).

A technical monograph was completed on chipmunks (*Tamias* and *Eutamias*) of North America, and a monograph approaching completion will treat the shrews (*Sorex* and other genera), a group of small, largely insectivorous mammals, which include in their number the smallest known species of mammal. Progress has also been made in the preparation of a revision of the kangaroo rats of the genera *Dipodomys* and *Microdipodops*, which have a marked effect in reducing the carrying capacity of stock ranges, and in some localities are injurious to grain crops.

#### BIOLOGICAL SURVEYS OF STATES

Owing to a limitation of funds, field work in biological surveys of States was confined to Arizona. In that State a representative of the bureau with an assistant spent a large part of the summer mainly in working a number of the isolated mountain ranges in the southeastern part, with a trip into the Hualapai Mountains at the end of the season. This completes the field work of the life-zone survey in Arizona, and the data are now available for the preparation of the final reports.

Progress was made in the preparation of reports on surveys already completed in other States, including one on the mammals of Oregon. Reports on the birds and mammals of Washington and on the birds of Florida and North Dakota are well advanced. Completed manuscripts on the mammals of New Mexico and North Dakota and on the birds of New Mexico and Texas are awaiting publication.

The manuscript on the birds of Alabama, resulting from a life-zone survey of that State, was published during the year in cooperation with the department of game and fisheries of Alabama. Efforts are being made to enlist the cooperation of other States in the publication of similar reports already completed by the bureau.

#### MIGRATION OF BIRDS

About 125 volunteer observers, scattered over a large part of the country, contributed reports on bird migration. Fortunately many of these were from cooperators who have made similar reports during many consecutive years, thus adding records of the highest value, since they are continuous notes taken at the same place during successive seasons. Such reports show



seasonal variations and thus afford data which, as a whole, represent average conditions. These migration observations are of the utmost value in determining the seasonal movements of birds and are of direct practical service in connection with the establishment of open and close hunting seasons for migratory wild fowl.

#### BIRD CENSUSES

Another form of local bird records is afforded by the enumerations of birds breeding in selected areas, usually occupied farm lands, including orchards and farm buildings. These bird censuses, taken during the nesting season, indicate the abundance of resident bird life under average country conditions. About 75 observers sent in such reports during the year. Many censuses were taken on areas similarly covered during past seasons, thus giving an opportunity to note seasonal or other local changes which may have occurred. During the year Department Bulletin No. 1165 was issued, containing a summary of the data reported by cooperators in this work from 1916 to 1920, inclusive, being complementary to earlier reports on this subject.

#### BIRD BANDING

The banding of migratory and other birds for the purpose of studying their seasonal and local movements and of gathering other information concerning their habits has made notable progress during the year. The voluntary cooperators in this study now number 971, as against 851 the previous year. Of these, 81 are located in Canada. The large percentage of cooperators remaining in the work from year to year is gratifying, as it not only shows a sustained interest in the investigation but at the same time supplies information from specific locations through a period of years, which is more valuable than if limited to a single season. That a knowledge of the species of birds is of prime importance to those engaged in bird banding is obvious, as without it they can not accurately identify the species on which they place the bands, and every effort is made to maintain a high average of efficiency among the cooperators, who are doing so much to add to our knowledge of bird life. The birds banded during the year number 40,432, a large increase over the pre-

ceding year. The number of returns of banded birds, not including those repeatedly taken in the same trap, was nearly 2,000. Details of 100 species recovered, of which 13 were ducks, will be published shortly in Department Bulletin No. 1268, "Returns from Banded Birds, 1920 to 1923," in press at the close of the year. The information concerning the routes followed and rapidity of travel of banded birds gives us facts of prime importance in connection with the administration of the migratory bird treaty act.

During the year two new bird-banding associations were organized; one to cover the territory inclusive of New York and thence south, and the other as a chapter of the Cooper Ornithological Club to coordinate the work of bird banding from the Pacific coast eastward to the Rocky Mountain region. There is little doubt that these new organizations will have the same effect as those previously organized in developing increased interest in the work in the territory they cover. Definite investigations are encouraged by regional associations according to the special opportunities of their territories. This unquestionably adds to the attractiveness of the work and at the same time develops desirable special information. One association specialized during the present year in the banding of black-crowned night herons; another concentrated on gulls and terns.

With the assistance of a cooperator a representative of the bureau the last of July, 1923, banded a large number of gulls and terns in breeding colonies of these birds near St. James, Mich. During February an investigation on the occurrence and habits of mourning doves, with a view to developing methods of capturing and banding these birds in considerable numbers, was made in the vicinity of Thomasville, Ga. Representatives of the bureau made a number of addresses before local organizations and associations concerning bird banding. The establishment of trapping stations has been encouraged and mimeographed communications have been distributed to cooperators with a view to developing the possibilities of the work to the utmost.

A circular of the department (Miscellaneous Circular No. 18), "Instructions for Banding Birds" was issued and generally distributed during the year for the purpose of developing uniformity of effort in banding along lines which have proved most effective.

### EXPEDITION TO THE DELTA OF THE YUKON

About the middle of February a co-operative expedition was dispatched to the great breeding grounds of migratory wild fowl lying immediately south of the Yukon Delta. The purposes of this trip were to gather as much information as practicable concerning the numbers and breeding habits of the geese, ducks, and other species frequenting that area, and later in the season, after the birds had molted their flight feathers, to band as many as possible in order to give some clue to the wintering grounds in the United States of the wild fowl which breed on the shores of Bering Sea. To reach these remote breeding grounds the party proceeded by steamer and rail to Nenana, on the Tanana River, about 65 miles from Fairbanks, Alaska, and thence a party of four traveled with two dog sleds a distance of about 800 miles to the point of their operations near the head of Hooper Bay, which was reached about the time the birds were arriving on their breeding grounds. The party found a great abundance and variety of birds and were very successful in securing the material and information desired during the breeding season. Banding operations were not undertaken until after the close of the period covered by this report.

It is believed that before thoroughly adequate efforts can be made to maintain our supply of migratory wild fowl it will be necessary to conduct banding operations on a considerable scale on the great breeding grounds of wild fowl in both Alaska and northern Canada. When this is done and the banded birds are taken during their migrations and in their winter homes direct relationship will be revealed between the various breeding and wintering grounds of birds, and necessary special protection may be afforded to areas where it appears to be needed. Research has been continued to obtain additional information affecting the increase of wild fowl, particularly as regards their breeding and migration.

### CONFERENCES ON CONSERVATION OF WILD LIFE

Along with other educational work of the bureau, that of having representatives take part in meetings having to do with the conservation of wild life has continued. The most notable of these was the Conference on Outdoor Recreation called by the

President in Washington May 22 to 24, 1924.

A representative of the bureau was present throughout the annual session of the American School of Wild Life Protection, at McGregor, Iowa, where lectures were given on conservation and on the harmful effects of the excessive draining of lakes and marshes. In connection with these conservation activities visits were made to other points in Iowa, Nebraska, Colorado, and Illinois, where wild-life refuges and parks were visited and conferences held with State and local officials.

Representatives of the bureau also attended the Fourth National Conference of State Parks, at Gettysburg, Pa., May 26 to 28, during which several parks in that region were visited and data obtained on the work being done by the State in connection with the conservation of wild life and the promotion of the public health and recreation.

In July, on request, an expert of the bureau visited Swan Lake, in Minnesota, an important breeding place for several species of wild fowl. This was in connection with efforts of the State game commission to prevent drainage of this important wild-life resort. An examination of the lake showed that little change had taken place in the fauna and flora since it was originally surveyed by the bureau in 1917. The evidence obtained by the representatives of the bureau was presented to the court as a part of the State's case in defending this area from drainage. It is gratifying to record that the decision of the court was against the draining of this lake.

### GAME IN NATIONAL FORESTS AND NATIONAL PARKS

Early in September, 1923, a brief visit was made to the Grand Canyon National Game Preserve, in Arizona, where additional information was obtained concerning the rapidly increasing number of deer in this area and the forage conditions. During the last part of May, 1924, an examination was made of game and forage conditions on the National Bison Range. Conditions were found to demonstrate the fact that this range has become overstocked. There is urgent need of a reduction in the number of game animals there, and cross-fencing and corrals should be established in order that the game herds may be handled advantageously in utilizing forage to the best advantage and to maintain the game herds up to the carrying capacity of the range. In May and



June, at the request of and in co-operation with the U. S. Forest Service and the National Park Service, the bureau participated in an investigation of the forage conditions affecting the northern elk herds of the Yellowstone National Park and adjacent national forests. The purpose was to gather information which would develop a better utilization of the winter forage available for elk on the Gallatin National Forest and other areas in that region. These investigations will be continued with a view to assisting in the better conservation of the elk herds there.

#### ACCLIMATIZATION OF TROPICAL GAME BIRDS

Through funds provided by Howard E. Coffin, a cooperator of the bureau, a naturalist was sent to the Lake Peten region in Guatemala in 1923 for the purpose of securing a number of ocellated turkeys, curassows, and tinamous. These were to be placed on Sapelo Island, on the coast of Georgia, where it was hoped that conditions might be favorable for their increase. The ocellated turkey particularly will become a wonderful addition to our domestic fowls if it can be successfully acclimatized. More than 40 chachalacas were taken in Tamaulipas, Mexico, and placed on Sapelo Island. In the fall five ocellated turkeys and a number of curassows and large tinamous were brought to the island from Guatemala. Unfortunately, some of these birds perished through one cause or another soon after they were liberated. Later all the remaining turkeys died. Further funds were provided and the naturalist returned to the Lake Peten region to obtain additional stock. Gratifying reports have been received to the effect that some of the chachalacas nested on Sapelo Island during the spring of 1924.

#### HABITS OF RODENTS

An assistant was occupied from July to October in northern Michigan studying the life habits of various wild mammals—especially the beaver—and their relation to agriculture and forestry. In addition to making field observations he brought to Washington living examples of several small species for detailed studies of their breeding and other habits, including food preferences. A report was published during the year on "Breeding, Feeding, and Other Life Habits of

Meadow Mice (*Microtus*)," in the Journal of Agricultural Research.

Observations have continued on the fenced quadrats established several years ago in Arizona to determine quantitatively the damage wrought by prairie dogs and other rodents on the stock ranges. The conclusions obtained from this source have been very striking. The value of these studies is obvious and it is desirable that the experiments be continued. A preliminary report will be available shortly as Department Bulletin No. 1227, "Damage to Range Grasses by the Zuni Prairie Dog."

At the request of the Forest Service a definite study has been undertaken of the relations of rodents to the forests and to reforestation in the yellow-pine region of the high table-lands and mountain slopes of northern Arizona. Experience in that region has shown that a definite knowledge of the various species of rodents and their habits, and practical methods for their control, must be gained before successful reforestation can be carried on.

Intensive field and laboratory studies and experiments have been continued in regard to several species of rodents peculiar to the northwest coast region in Washington, with special reference to their relations to agriculture, horticulture, and forestry. Progress has also been made in a special study which is being conducted in southern Arizona of the relation of jack rabbits to agriculture and the forage production on the open ranges.

#### ALASKA REINDEER

With the development of the reindeer investigations it has become plain that much larger and more suitable quarters, including sheds and corrals for the animals and buildings for the laboratory and living accommodations of the members of the staff, must be made available before the important investigational work of the bureau for the aid of the reindeer industry can be fully effective. Inquiries are being conducted in various parts of the reindeer territory to determine what location offers the best facilities for the principal reindeer experimental station.

In addition to studies of diseases and parasites which can be undertaken at such a station, feeding experiments to determine the comparative nutritive values of different types of native forage on the ranges are greatly needed. A knowledge of them is essential in connection with the



establishment of grazing allotments to herd owners. In addition, more extensive experiments are desirable to determine fully the value of feeding grain to reindeer used for hauling passengers and freight. The initial experiments of this kind, although made under great difficulties at Nome, indicate very clearly that there are great possibilities for utilizing reindeer instead of dogs in communicating with reindeer herds and in transporting supplies. Not only will the utilization of these animals be convenient to herd owners but it will result in a marked reduction in cost for such services.

Studies of the abundance and distribution of forage plants to determine the carrying capacity of ranges have been continued. At the same time observations of quadrats have been continued to determine the rate of reproduction of lichens and other forage plants. The results of these studies and of the ranges indicate that from 45 to 60 acres of range will be needed to carry each reindeer through the year. Information gathered appears to indicate that a burned-over range may require from 15 to 30 years to re-cover. A study of lichens on quadrats indicates a reproduction growth of from one-eighth to one-half inch a year.

#### POISON PLANT PROBLEMS

During the past two years losses from poison among reindeer, mainly fawns, have been reported among herds on the Kobuk River and on the Kuskokwim. Investigations appear to indicate that the branched *Equisetum*, or "horsetail," might be responsible, as the areas where the losses occurred proved to be wet, marshy ground where there was a vigorous growth of *Equisetum* in advance of the other vegetation. Some of these plants, as well as some monkshood, dried and fed to reindeer later as hay, failed to show any ill effect.

#### HERD MANAGEMENT

Reindeer herds were visited from Point Barrow, the northernmost point on the Arctic Circle, to Nunivak Island in Bering Sea, the opportunity in every case being taken advantage of by bureau representatives to explain to the herd owners improved methods of herd management. This educational work is appreciated by the owners, whether they be Eskimos, Laplanders, or Americans. During the summer of 1923 the experimental

station power schooner *Hazel* traveled more than 2,500 miles in this work.

Among other practical results of our educational campaign has been the establishment of 10 corrals, which are in use in different places for handling reindeer, and instead of following the old, destructive methods seven other herd owners are planning to build corrals in the near future.

Studies of measurements and comparative growth of reindeer indicate that steers are at the most profitable marketing stage when 3 years old. Spotted and white reindeer average smaller than uniformly dark-colored animals, and in many herds are being eliminated from the breeding stock.

#### NUMBER OF REINDEER IN ALASKA

No accurate count of the reindeer herds owned by Eskimos and many of the others is practicable until corrals are in general use. Estimates based partly on counts giving a working approximation of the numbers in 66 herds have been made, and, using these as a check against the estimates of other herds, it is believed that in the year 1923 the number of reindeer in Alaska totaled about 241,000. The increase each year runs from 33 to 45 per cent of the total number of animals in the herd. This percentage can be increased by more careful herd management. Through the educational work of this bureau some of the Eskimos owning small numbers of reindeer are uniting them in community herds. One group of 72 owners, located near Shaktolik and Bonanza, have made a cooperative herd of 6,000 animals, and 68 owners at Council and White Mountain have formed a community herd of about 4,000. By handling these herds as units the percentage allotment of the increased expenses can be greatly reduced and the ownership of the animals brought to a more businesslike footing, with a much better chance of profitable results to the natives. This kind of management is especially necessary in connection with the marketing of surplus animals.

#### MARKETING FACILITIES

Two American companies are now operating refrigerating plants to receive reindeer carcasses for the purpose of shipping them to markets in the United States through Seattle. One of these operates refrigerating barges which can move from one point to another, mainly in the rivers, and the other company has several small

cold-storage plants along the coast, the number of which will be increased. Only about 90 tons of reindeer meat was shipped from the Territory in 1923, but it is anticipated that from this time forward there will be a rapid increase in the shipments.

#### PREDATORY ANIMALS AND REINDEER

It is reported that the Kobuk reindeer herds have been losing about 200 animals a year from the depredations of wolves. Lynxes are said to kill a few animals and red foxes occasionally kill a fawn. Reports have been received of occasional inroads of grizzly bears among the herds; however, the loss from this source has been small except through the demoralization and scattering of the herds through fright.

#### AID TO SHIPWRECKED CREWS

Following a terrific storm in the Bering Strait region last September, in which numerous small trading vessels were caught, the reindeer station schooner *Hazel*, the only boat available at Nome, was sent out as a relief ship. On September 24 the *Hazel* returned to Nome from Bering Strait bringing 19 passengers from the storm-bound boats at Teller, including members of a United States Geological Survey party and the crew of the wrecked schooner *Woods*.

#### CARIBOU

Investigations of Alaskan wild caribou have been continued for the double purpose of determining the status of these valuable game animals and at the same time supplying the necessary information which will enable the bureau to secure young bulls for breeding experiments in selected reindeer herds.

#### PROTECTION OF ALASKA LAND FUR ANIMALS

Progress has been made during the year in the work of protecting land fur-bearing animals, although handicapped by an inadequate law and lack of funds to maintain a sufficient warden force. The educational work conducted by the bureau's wardens in Alaska is showing results in a most substantial way, and there is a gratifying growth of sentiment throughout the Territory for better conservation of the fur resources.

By new regulations affecting fur animals, promulgated May 20 and ef-

fective July 1, 1924, the close season on beaver was continued, and in addition a close season was placed on marten. From reports received it was evident that martens were becoming scarce in districts where formerly abundant, and a close season was urged by Alaskans, including some fur traders, in order to give the animals a chance to increase. There was a like condition regarding beavers and it was deemed advisable to continue protection of these animals through another trapping season.

It is now unlawful to trap any land fur-bearing animal, except wolves, in the drainage of the Taku River between the Canadian boundary and a line drawn from Taku Point to the east end of Taku Glacier. This regulation was made in view of the fact that under new regulations promulgated for the protection of game in certain localities in Alaska that region practically had been made a game refuge—principally in order to give protection to a small number of moose there.

Fur warden service was established at Flat and Ketchikan in addition to that already maintained at Nome, Fairbanks, Anchorage, Unalaska, Cordova, and Belkofsky, and continued cooperation has been splendidly rendered by the Treasury Department through its customs service and by agents of the Department of Justice. As a result there have been comparatively few serious violations of the fur law and regulations, a condition which speaks well for the inhabitants, a large majority of whom believe in properly conserving the animals, which are such a valuable asset to them in helping provide their livelihood.

#### PROSECUTIONS AND SEIZURES

Seizures totaling 1,815 skins were made during the year, a few because they were unprime, but in the main because they were trapped out of season. Of these skins, 66 were of beaver, 1,749 muskrat, 2 red fox, and 1 mink. In only two cases have proceedings been instituted. These involved the seizure of 1,399 muskrat skins at Nenana, and will come up for trial at the fall term of Federal court at Fairbanks. No attempts to prosecute other violators were made, inasmuch as the parties from whom seizures were made willingly signed releases to the Government, and the loss of the furs with a warning as to illegal trapping was considered sufficient for the first minor offenses.



## SHIPMENTS OF ALASKA FURS

Shipments of furs from the Territory, covering the period December 1, 1922, to November 30, 1923, as reported by postmasters and agents of transportation companies, indicate that the fur industry continues an important one. The number and value of skins shipped show a slight increase over the previous year. A total of 396,369 skins, valued at \$1,702,000, were exported. These, together with skins brought out of the Territory by travelers and by vessels not reporting them, and skins of blue and white foxes from the Pribilof Islands, which come under the jurisdiction of the Bureau of Fisheries, will bring the total value of fur exports to more than \$2,000,000.

The number of the principal pelts and their value were as follows:

*Number and value of the principal pelts shipped from Alaska during the year December 1, 1922, to November 30, 1923*

Kind of fur	Number	Value
Muskrat.....	319, 611	\$367, 552
White fox.....	7, 051	296, 142
Beaver.....	14, 341	258, 138
Red fox.....	10, 787	215, 740
Mink.....	20, 668	165, 344
Marten.....	6, 726	154, 698
Blue fox.....	830	83, 000
Silver-gray fox.....	252	44, 100
Otter.....	1, 781	35, 620
Cross fox.....	993	29, 790
Lynx.....	1, 585	26, 315
Weasel (ermine).....	10, 276	9, 248

## GENERAL ACTIVITIES

Continued patrolling of the waters and streams of southeastern Alaska with the bureau's seagoing power boat *Sea Otter* in the protection of land fur bearers, in addition to enabling wardens to visit important trapping sections and assist in educational work among natives in the conservation of wild life in general, has had a tendency to keep down violations to a minimum. It was possible also while patrol work was carried on to visit fur farms and give practical assistance to fur farmers.

## FUR FARMING IN ALASKA

All but 1 of the 10 islands lying off the southern coast of the Territory, and under the jurisdiction of the bureau, have been re-leased to the present holders for a term of three years at the same rental as before. Reports indicate that lessees are meeting with

fair success in their operations, and all are optimistic as to the future.

Interest in blue-fox farming continues to increase, many inquiries regarding the industry coming from people in the States. With continued growth of the industry all islands suited to it will shortly be occupied by reliable fur farmers, provided that legislation is enacted by Congress to give them proper protection. At present there is no authority for leasing many islands along the southern coast outside of Government reservations nor of issuing permits for fur-farming purposes there.

There are now a total of 212 fur farms in operation in the Territory. Both blue and silver foxes are being reared, and on some of the smaller fur farms attempts also are being made to propagate such smaller fur bearers as the mink, marten, muskrat, and beaver. Of the total number of fox farms 119 are on islands in southeastern Alaska, 31 in the Prince William Sound region, 14 in the Kodiak-Afognak region, 13 on islands off the coast of the Alaska Peninsula, 9 in the Cook Inlet region, and 26 on islands within the Aleutian Islands Reservation. Two new associations of fox farmers have been organized, one with headquarters at Cordova, the Cook Inlet Silver and Blue Fox Breeders' Association, and another, the Southwestern Alaska Blue Fox and Fur Farmers' Association, with headquarters at Kodiak. This makes four such organizations in southern Alaska.

Applications for permits to capture alive for propagating purposes such fur bearers as beaver, marten, mink, and muskrat continue to be received. A total of 21 were issued this year. These are granted to responsible parties, to whom all possible encouragement is given to try experiments with these fur bearers in captivity. Seven special permits to capture foxes for propagating purposes have also been issued, a majority of them being for white foxes in the northern part of the Territory, where attempts will be made to rear these animals in captivity.

## PROTECTION OF ALASKAN GAME

An important piece of legislation affecting the enforcement of the Alaska game laws, enacted by Congress and approved by the President June 7, 1924, transfers the administration of the Alaska game law from the governor of the Territory to the Secretary of Agriculture, including \$20,000 ap-



propriated to the Department of the Interior for enforcing the law. By this act the dual warden force in the Territory hitherto existing will end, and one force, known as United States game wardens, operating under one chief Alaska game warden, will enforce both the game laws and the laws relating to land fur-bearing animals. This change, effective July 1, 1924, will greatly increase the efficiency of the warden service as a whole and prevent duplications in assignment.

#### PREDATORY ANIMAL CONTROL

Work undertaken during the preceding year for the destruction of wolves, which have been preying upon game and fur animals on islands in southeastern Alaska, was continued. An experienced hunter was again assigned to investigate conditions and destroy wolves. Additional information of interest was gathered and a number of wolves were killed by use of traps and poisons. The practicability of destroying wolves on these islands whenever funds are available for the purpose has been fully established, and a marked scarcity of these animals was noticeable, doubtless due to the operations last year of the bureau's predatory animal inspector.

#### GAME AND BIRD RESERVATIONS

Increase in the public appreciation of the worth of game refuges as a means of protecting and perpetuating our wild life is demonstrated by the steady demand for inclusion in refuges of this kind of land needed for breeding and feeding areas for birds and mammals. As an example of this interest may be mentioned a communication from the Commissioner of Light Houses requesting the cooperation of this bureau in an examination of several lighthouse reservations in Lake Erie, Lake Huron, and Lake Superior to determine whether they included areas which were worthy of having bird refuges established upon them. At the same time the number of State wild-life refuges is rapidly increasing.

**Survey of antelope.**—Some years ago the American bison or buffalo was reduced from the untold millions once existing on this continent to a few hundred survivors in the northern Rocky Mountain region. The American Bison Society was organized and steps taken which have resulted in the reestablishment of these animals on a scale which has eliminated the

danger which threatened them. At the present time the American antelope, one of our most beautiful and interesting large game animals, stands in danger of the fate which threatened the buffalo. For several years conservationists have been interested in these animals and various suggestions have been made for their conservation in different parts of the West.

During the past two years the Biological Survey has been conducting a census to ascertain the numbers in various States and the location of the herds. This has been completed and shows that there are approximately 25,000 of these animals surviving in North America, by far the greater number of which are within the United States.

In order to get an expression of the sentiment in regard to the conservation of these animals, the Chief of the Biological Survey called an antelope conference to be held at the National Museum in Washington on December 14, 1923. This was attended by conservationists from all parts of the country. The status of the antelope as shown by the census recently completed was brought to their attention and a discussion was held as to what might be done to perpetuate these animals. The principal conservation organizations of the country were represented and a general agreement was reached as to cooperation in conservation work in favor of these animals, with the Biological Survey to serve as the source of information concerning conditions in the various parts of the country where these animals occur and to assist in the work.

**Antelope in Nevada.**—During the year the Governor of Nevada requested the cooperation of the Biological Survey in locating and establishing antelope reserves along the northern border of the State. This request was met and the refuges were established. Later these were enlarged so that now about 5,000,000 acres are included in the Nevada State game refuges with between 3,000 and 4,000 antelope ranging in them.

The Biological Survey and the Permanent Wild Life Protection Fund in cooperation will mark the boundaries of the two great antelope refuges established in northern Nevada, on which in the spring of 1923 there were estimated to be a total of about 3,000 antelope.

In cooperation with the American Bison Society and the National Association of Audubon Societies movements were begun for the establish-

ment of national game refuges in Lake County, Oreg., and Owyhee County, Idaho, to protect antelope and sage hens, but not receiving unanimous local approval the matter has been held in abeyance for further consideration.

In the spring of 1923 the Governor of Nevada granted the Biological Survey the privilege of capturing 40 young antelope on the Washoe State Game Refuge in the northwestern part of that State, which was believed to contain at that time about 2,000 antelope. One of the predatory animal hunters of the bureau has a ranch in the midst of this refuge and he with assistants was detailed to capture the antelope immediately after they were born. The 40 animals were captured without difficulty and were being raised successfully on milk from bottles. Funds for securing these antelope were donated by Dr. E. E. Brownell, of San Francisco, and Dr. W. T. Hornaday, from the Permanent Wild Life Protection Fund. It is planned to place 12 of these animals at Hermit Basin in the Grand Canyon National Park in Colorado, and to divide the others between the Niobrara Game Refuge in Nebraska and the National Bison Range in Montana.

**Other new refuges.**—Near the end of the session of Congress, in June, 1923, a bill was passed authorizing an appropriation of \$1,500,000 for the purchase of bottom lands along the upper Mississippi River to establish a refuge for birds and other wild life and fish. This should become one of the greatest and most important refuges in the country. While important for bird and mammal life, it is even more vitally necessary for the welfare of black bass and other fish.

Blackbeard Island, at the entrance of Sapelo Sound, Ga., was again made a bird refuge under the jurisdiction of this department by Executive order of February 15, 1924. It is desired to use it as an experiment station for the acclimatization of certain game birds introduced from Mexico and Central America. Among these are ocellated turkeys, curassows, and chachalaccas.

### BIG GAME RESERVATIONS

The winter of 1923-24, like the one before, was mild over every portion of the West, so that the winter losses of game were light and the young of the previous year came through with

better than normal growth. In fact, the increase on the big game preserves has been so satisfactory in recent years that it has been found necessary to dispose of the surplus animals which can not be supported by the forage production of these areas.

For several years work has been in progress to extend the game fence of the Niobrara Reservation in Nebraska to include 4,000 acres of additional pasture. This was completed in June, 1923, and the buffalo and elk which had heretofore been held in two comparatively small inclosures were moved into their new and very fine range.

Despite the war against predatory animals, a few antelope have been killed from the small surviving band at the Wind Cave Game Preserve in South Dakota. Every effort is being made to protect these animals through the services of a skilled predatory animal trapper. An attempt was also made to render the fenced pasture coyote-proof by placing stones along the ground at the bottom of the fence.

It may be added here that in this fenced refuge, and in the Bison Range in western Montana, the heavy losses of antelope have been in the face of a persistent warfare against predatory animals, during which hundreds of coyotes and other predatory animals have been killed. The danger arising from these animals is due to their ability to come in from great distances during storms and thus nullify the results of having cleaned up all such animals in the neighborhood.

The following tables show the number of big game animals on the refuges under the jurisdiction of this bureau:

*Big-game animals on reservations maintained by the Biological Survey at the close of the calendar years from 1916 to 1924 (in 1924 to June 30 only)*

Year	Buffalo	Elk	Antelope	Mule deer	White-tailed deer	Mountain sheep	Total
1916-----	206	165	47	2	3	-----	423
1917-----	251	205	57	2	6	-----	521
1918-----	311	261	55	15	8	-----	650
1919-----	381	345	54	21	9	-----	810
1920-----	431	433	65	27	5	-----	961
1921-----	508	519	91	54	21	-----	1,193
1922-----	603	1,608	21	152	131	15	1,330
1923-----	717	1,657	16	162	127	120	1,499
1924-----	866	1,843	7	182	131	28	1,857

<sup>1</sup> Estimated.



*Distribution on June 30, 1924, of big-game animals on reservations maintained by the Biological Survey*

Kind of game	Bison Range	Wind Cave	Nio-brara	Sullys Hill
Buffalo.....	675	126	51	14
Elk.....	1 500	1 250	1 53	40
Antelope.....		7		
Deer, mule.....	180	2		
Deer, white-tailed.....	1 25		1	1 5
Mountain sheep.....	28			
Total.....	1,308	385	105	59

<sup>1</sup> Estimated.

**National Bison Range, Mont.**—The rapid increase of large game animals on the National Bison Range indicates that it is ideally suited to their requirements. The last of June, 1924, the range contained 675 buffalo, about 500 elk, 80 mule deer, 25 white-tailed deer, and 28 mountain sheep. The increase has been so unexpectedly great during the last two years that the range has become overstocked, and it became necessary the fall of 1923 to dispose of part of the surplus by killing some and disposing of the meat.

Fortunately, the following winter was mild and the grass on the range was available throughout the season. Notwithstanding this, however, in April the buffalo and other game animals were thin, the deer appearing to be in the best condition. A dry, cold spring, with high winds, evaporated the surface moisture and retarded the growth of forage. Some of the best grasses had become completely dried before the first summer rains. In the spring about 400 buffalo were taken off the main range and held in a pasture in order to allow a good growth of forage on the range. These buffalo were fed from April 1 to June 15 an average of about 18½ pounds of alfalfa hay per day. This was about 10 pounds to the animal less than they would have eaten had it been available. They ate the hay readily, however, and gained in weight. The reproduction of forage on the range during the spring was disappointingly small.

The calf crop in the buffalo herd for the spring of 1923 amounted to about 100 on June 30. The losses of buffalo from the herd from natural causes during the year amounted to 3 bulls, 6 cows, and 8 calves. Twenty-nine bulls were killed and sold for meat.

Evidences of beaver work among the trees along Mission Creek indicates

the presence of a number of these animals. The open winter and the dry spring were favorable for the pheasants and for the sharp-tailed grouse on the range. Many covies of young birds were seen.

Very few coyotes have been noted on the range since early in 1923, although occasionally tracks were observed and howls of the animals heard within the refuge. One of the Government trappers did considerable work within the inclosure and caught a number of animals. It is believed that they have now been thoroughly eliminated, but they are continually coming in from a distance, so that never-ending vigilance is needed to prevent their increasing and depleting the numbers of the game.

During the year some improvements were undertaken, including the building of a small barn at the assistant warden's quarters, two pens for corralling and feeding buffalo, and a half mile of fence on the east side of the range to inclose 20 acres, with a water front on Sabine Creek. In addition various current minor improvements and repairs to roads and buildings were made.

**Wind Cave National Game Preserve, S. Dak.**—The game animals on this refuge also have increased until they now number more than the forage limitations render desirable. In June there were located here 126 buffalo, about 250 elk, and 7 doe antelope. All the animals were in excellent condition, although the spring was late and severe weather conditions prevailed. Two bull buffalo were killed and disposed of and a bull and a cow died during the year. Eight surplus bull elk were killed and disposed of with the buffalo.

Early in 1923 a herd of 17 antelope were on this preserve, but at the end of the year only 7 remained. The losses were caused by predatory animals, despite the constant effort to control these pests through poisoning and trapping. Three coyotes were known to have gotten inside the fence. Two were poisoned within a few days and the third, not being seen after some time, was believed also to have been killed. The Government trapper employed on the range and in the surrounding country caught seven coyotes and four bobcats. He reports a few straggling animals in the surrounding country.

One of the striking circumstances connected with the destruction of antelope by predatory animals is their apparent helplessness, and particu-



larly the fact that predatory animals appear to kill adult males more readily than they do the females or the younger animals. This may be due to the habit many of the males have of wandering off by themselves.

The grouse on the preserve do not appear to be increasing, perhaps through unfavorable feed conditions brought about by the intensive browsing of shrub growth by the elk. Bobwhite quail were plentiful and five covies were known to be nesting in the spring of 1924 within hearing distance of the warden's headquarters. Winter feed for quail is important in this region. Three small fields of grain were sown for the benefit of these birds and of the grouse on the refuge, which helped carry them through the year. These plantings will be increased, and it is hoped will be helpful in increasing the number of birds.

The principal improvement on this refuge during the year was the installation of floodgates where the game fence crosses Cold Springs Creek. Trap corrals for capturing the game animals have been completed.

**Winter Elk Refuge, Wyo.**—During the summer and fall of 1923 about 784 tons of hay was harvested and stacked on the refuge. In addition, 179 tons were purchased from neighboring ranchers, and grazing rights were rented on 1,400 acres. The weather during the fall and early winter was very favorable to the elk, and so little snow fell during the hunting season that few of the animals came down from the Teton State Game Reserve. As a result a large number of hunters failed to kill their elk. The first band of 400 came down from the mountains and arrived at the refuge on December 11. The winter was so mild and the snowfall so light that throughout the winter elk were able to secure forage on the pasture land. The first two weeks in January the cold was severe, the temperature registering down to  $-31^{\circ}$  F., followed by high winds and drifting snow. A few warm days the last of January and the first of February were followed by freezing weather, which crusted the snow and covered some of the fields in the valley with ice. As a result, the feeding of elk with hay on the refuge began on February 4.

During the first week about 1,800 were on the Germaine tract and 600 near the warden's headquarters. By the end of February approximately 3,800 elk were on the two feeding grounds, and about 1,000 animals on

the foothills to the east. During the latter part of March this band came in to the refuge for feed, thus increasing the number to about 4,800 animals. This was about 1,200 more than were on the feeding grounds during the previous winter. The feeding period ended on April 9.

Approximately 565 tons of hay were used on the refuge during the winter and spring of 1924. Of this, 365 tons were harvested on the refuge and 200 tons were purchased by the State of Wyoming from neighboring ranchmen. There will be available for next winter 683 tons, in addition to 250 purchased by the State.

As a result of the open winter and favorable weather conditions, only 18 elk, including 3 calves, were found dead on the refuge and adjacent ranches, an extraordinary record. At the end of the feeding season in 1923, 4 cow elk were held in a large corral near the warden's headquarters, where 3 calves were born to them. Numerous tourists visited the refuge to see these animals, which later were released.

Some needed repairs have been made to the fences and headquarters buildings. The installation of a water system in the warden's house was a long-needed improvement.

**Niobrara Reservation, Nebr.**—The buffalo continued to thrive on the new pasture north of the Niobrara River, where they found forage throughout the season. Whenever considerable snow fell on the reservation the buffalo sought bare ridges, where they had no difficulty in finding food. This refuge contains 51 buffalo and 53 elk. Here, as in the other refuges, conditions appear to be favorable and the herds are increasing rapidly.

The predatory animal trapper assigned to this locality in November, 1923, remained until the following spring, during which period he caught 44 coyotes and 2 bobcats on the reservation and in the vicinity.

In the spring of 1924 a number of upland plover nested in the pasture and two pairs of quail located near the headquarters.

**Sullys Hill Game Preserve, N. Dak.**—In June, 1923, this small game preserve had 14 buffalo, 40 elk, and 5 deer, all of which were in fine condition. During the winter of 1923-24 nearly 40 tons of hay and straw were fed these animals. The heavy snow in this locality often buries the forage until much of it is inaccessible.

Considerable attention is being given by the warden on this refuge to stock-

ing it with birds. In June, 1924, there were 6 Canada geese, 13 mallard ducks, 3 wood ducks, and 1 golden-eye. Two pairs of golden-eyes nested in the boxes placed on the border of Sweetwater Lake on the refuge. This little lake, although surrounded by low woods, is frequented by a number of species of wild ducks during migration. Many nesting boxes have been placed about it and it is hoped that golden-eyes and wood ducks may make it their regular nesting place. About 50 Chinese pheasants are located on the refuge, where a number of them are nesting. Some of the increase has spread into the surrounding country.

This game refuge has an attractive grove within which lies Sweetwater Lake. Back of this rises Sullys Hill, the highest elevation in this neighborhood, from which is a beautiful view of Devils Lake and the surrounding country. This locality is a favorite resort and picnic ground for people of all this region. During July, 1923, more than 3,500 people visited the reservation; in August nearly 1,800; in September more than 1,100; from October to December more than 1,000; from January to May, nearly 300; and in June, about 1,100; a total of more than 9,000 during the year. These visitors are mainly residents of the surrounding region who find here their most attractive place for an outing.

Some additional improvements have been made on the hostess house. The entrance drive and gate have been finished and other small changes made which add to its attractiveness and convenience for visitors.

#### BIRD REFUGES

A total of 64 bird refuges are administered by the Biological Survey. These are located from Porto Rico to Chamisso Island near Kotzebue Sound on the Arctic coast of Alaska, and to the Hawaiian Islands. Some of these are celebrated breeding places for wild fowl and each breeding season are occupied by marvelous colonies of interesting species.

About the shore of Lake Malheur in eastern Oregon nest a great variety of wild fowl, including ducks, herons, and many others. On an island in Pyramid Lake, Nev., thousands of magnificent pelicans breed, and on Laysan Island, half way to Japan, hundreds of thousands of albatrosses and other beautiful sea birds rear their young.

The maintenance of these refuges is the principal insurance against the extermination of some of our most beautiful and attractive birds. Conditions at some of them may be mentioned.

**Hawaiian Island Reservation.**—In the spring and summer of 1923 an expedition was undertaken to Laysan Island to investigate conditions there and to destroy the domestic rabbits which had been introduced years before and had overrun this wonderful breeding place, nearly exterminating the vegetation. In the spring of 1924, through the courtesy of the Navy Department and the Bishop Museum at Honolulu, the warden of this reservation was enabled to visit the island and could find no traces of rabbits, indicating apparently the complete success of the efforts to eliminate these pests. The vegetation, which had been replanted by the party the year before, was coming on so well that apparently the island will again be partly clothed with plants and thus afford shelter to some of the species which can not survive without it.

**Big Lake Bird Refuge, Ark.**—A number of hollow-log nesting boxes were put in place here to add to the facilities for tree-nesting ducks. Three of them were promptly occupied by wood ducks. The low water and heavy growth of seed-producing plants produced favorable conditions and a large number of broods of ducks were hatched here the spring of 1924.

In the fall of 1923 the use of headlights on this lake was prohibited by regulation in order to prevent the disturbance of wild fowl there. As a consequence, during the spring and summer of 1923 the warden observed a notable increase in the number of frogs, which, through a heavy market demand for them, had been decreasing so long as the use of headlight hunting had been permitted. The drainage of surrounding land has also concentrated the frogs of this district more and more in the lake.

It is gratifying to note that the residents of the region about this refuge are coming more and more to appreciate its benefits to the community in providing a breeding place for the wild fowl which pass from it into the surrounding country and thus offer opportunities for sport.

**Lake Malheur Bird Refuge in Eastern Oregon.**—Owing to the extremely light snowfall during the winter of 1923-24 in the mountains at the headwaters of the stream supplying Lake Malheur, water was unusually low in the lake



in the spring and summer of 1924. The low water and extremely cold weather of spring interfered with the usual growth of cat-tails, rushes, and other plants. As a result the dry plants of last year's growth became a great fire hazard early in the spring. Although every precaution was taken by the warden, a fire occurred, causing heavy loss through the destruction of the plant growth over great areas used by the birds for nesting. It also destroyed quantities of hay on the adjoining meadows, a serious loss to the owners.

The dry season, however, appeared to be especially favorable to the long-billed curlew, a large number of which nested in the short-grass pastures adjoining the refuge. A large colony of black-necked stilts, which the warden had not before noted on this refuge, appeared in the spring of 1924 and reared their young, as did a large number of Canada geese. Many swans visited the lake during the spring before passing on to their breeding grounds farther north. Owing to the very low water the growth of wapato, or water potato, over much of the area where the swans usually feed will render conditions unsatisfactory for them the coming autumn.

**Clear Lake Bird Refuge, Calif.**—For some years a point of land on this bird refuge extending into Clear Lake has been invaded by sheep each spring and the vegetation destroyed. This rendered conditions very unfavorable for the breeding birds. In the spring of 1924 more than a mile of sheep-proof woven-wire fence was built across the neck of this point to exclude the sheep and permit the shrubs and other cover to grow sufficiently to accommodate the breeding birds.

This area is used extensively as a breeding place for large colonies of white pelicans, terns, and cormorants, as well as by geese and ducks. Observations on the effect this protection of plant growth will have in attracting birds will be of great interest. The fencing of this area will have another practical purpose as a check plot for observation of the administration of the adjacent forest land as to forage production in comparison with the adjacent grazed area.

**Florida bird refuges.**—During April and May, 1924, a visit to several bird refuges in Florida showed a marked decrease of some of the species of birds breeding there in preceding years. But little trespassing appeared to have taken place, and the decrease of the birds appeared to be coincident with

the decrease in their numbers in other parts of the State away from the refuges.

Interest is awakening in this State in the conservation of its wild life and it is hoped that sufficient areas may be safeguarded to permit the perpetuation on a considerable scale of the native birds of the State. Unfortunately the exceedingly great increase of winter visitors, with rapid development of automobile roads and the use of streams by motor boats, is unquestionably having a most adverse effect upon the wild life of Florida.

Pelican Island Bird Refuge, near Sebastian, in the Indian River, has been celebrated for many years as the breeding place for hundreds of pairs of brown pelicans. In 1922 the mangroves were cut away on the shore half a mile or more away from the island and two small houses built. This and the passage back and forth to them of motor boats appeared to affect the pelicans so that less than 100 nests on the point of the island farthest from the houses represented all the pelicans left there the spring of 1924. Word was received that a great increase of breeding pelicans had taken place on an island to the north in Mosquito Lagoon. Later when the young were partly grown this "rookery" was invaded and more than 1,200 of them, by actual count, were killed with clubs by unknown vandals.

#### MIGRATORY BIRD TREATY AND LACEY ACTS

The direct benefit to our migratory wild fowl supply resulting from the prohibition of spring shooting and the sale of game, with the establishment of reasonable and uniform bag limits for these birds, is becoming more and more generally appreciated throughout the country. Many who were originally greatly opposed to the law are now numbered among its strongest supporters.

Information continues to be received that ducks are now nesting in suitable areas in the Northern States in great numbers, where previous to the passage of the migratory bird treaty act the nesting birds were very few. An extraordinary increase in breeding black ducks is reported from the marshes of Maryland north to Maine, as well as in Canada. It has been reported also that the breeding of blue-wing teals in some of the western States has enormously increased.



Unfortunately, the funds available for the administration of the migratory bird treaty act permit the employment of only about 25 full-time Federal game wardens to enforce the law throughout the United States and Alaska. It is obviously impossible thoroughly to enforce the law with such an inadequate warden service. The case would be hopeless were it not for the friendly cooperation of State game commissions and of others interested in conservation. Despite every effort, however, there is a steady growth of violations of the migratory bird treaty act, involving hunting during close seasons, market hunting, shooting from powerboats and sailboats, and the killing of such protected species as wood ducks and swans.

The bureau continues to receive complaints of violations of the law from all parts of the country, sometimes couched in critical terms, but with its limited funds it is prevented in many instances from taking action. This is not only embarrassing to the bureau but has a serious effect, since so much apparent immunity assists in causing disrespect for the law. Should these increasing violations continue, they can not but have an adverse effect on the maintenance of our supply of migratory wild fowl.

#### DRAINAGE

Conservationists and sportsmen have been seriously disturbed over the increasing danger to the future of the migratory wild fowl, which has developed through the progress of drainage operations. As the population increases the demand for land for agricultural purposes increases correspondingly, and the destruction of each water area has a distinct effect on our supply of migratory wild fowl, fur bearers, and fishes.

The Biological Survey appreciates the fact that drainage operations are often desirable and that frequently the resulting lands made available are distinctly more valuable than was the original water area. At the same time the investigations of the bureau have shown conclusively that a vast amount of indiscriminate and ill-judged drainage has taken place whereby water areas have been destroyed with their attendant productiveness for the benefit of the public, to be replaced by worthless lands which remain unutilized, or if utilized are of little or no value. Such operations are expensive and in many cases

involve serious direct losses to the owners and to the interests of the community.

During the year many water areas were drained and plans made to extend drainage activities. It is hoped that hereafter better consideration will be given to the relative value of water areas as producers of game, fur, and fish, and also to their recreational value.

Fortunately, some States have already legislated to regulate drainage enterprises. In certain of these, as in Iowa and Minnesota, effective work has been done to save some of the water areas. Nowhere, however, do the laws recognize the public value of water areas and the desirability of limitations on their drainage until after a proper survey has been made and their value from an agricultural point of view determined as compared with their value to the community as recreational centers and as producers of game birds, fur bearers, and fish.

The difficulties connected with conserving water areas are great and the States will be handicapped in alone meeting the situation. As a consequence the feeling has grown among conservationists and sportsmen that the Federal Government, having control of migratory birds, should aid in bringing about the conservation of water areas in order to help maintain the numbers of these birds.

As during several preceding years, the Biological Survey has continued its surveys of water areas with a view to obtaining definite information as to their values in relation to the maintenance of the supply of migratory wild-fowl, fur animals, and fish. The information gained by these surveys is being drawn upon to assist in the development of conservation in the States as well as in the administration of the migratory bird treaty act and in carrying out the general conservation policies of the bureau.

#### COOPERATION

Throughout its administration of the migratory bird treaty act the Biological Survey has appreciated the vital need of the friendly cooperation of the State game services and of sportsmen's and other conservation organizations, in order that a sentiment might be built up throughout the country favorable to the observance of this law. It is a grateful task to acknowledge the indebtedness of the bureau for the continued friendly help it has received

from such sources. In view of the very limited amount of funds for the enforcement of the migratory bird treaty act, a large share of the effectiveness of its administration rests on such cooperation. Many single States have a larger fund for the administration of their game laws than is available for the Federal work covering the entire country.

#### MIGRATORY BIRD TREATY ACT ADVISORY BOARD

The 1923 meeting of the advisory board was held in Washington on December 13, with 19 of the 22 members present. The numerous recommendations for changes in the regulations received during the year were submitted and carefully considered by the board, whose advice and suggestions proved to be in complete harmony with the policies of the department and were very helpful to it in reaching its decisions. In this connection it is worthy of mention that there has always been the fullest cooperation between the Biological Survey and the advisory board. During this year only minor changes were made in the regulations involving the open seasons for mourning doves in Louisiana and Mississippi and waterfowl, coots, gallinules, and Wilson snipe in New York.

#### PERMITS TO KILL MIGRATORY BIRDS

A limited number of complaints continue to come in alleging serious injury to crops or other interests by migratory birds. Exercising his authority under regulation 10 of the migratory bird treaty act regulations, the Secretary issued an order permitting the director and employees of the department of conservation of Michigan to kill merganser ducks and great blue herons at any time within that State when found destroying valuable fish life in rivers, lakes, and streams. This order was based on the findings of investigations conducted by experts of the Biological Survey, which confirmed complaints received from Michigan that these birds in various localities were exceedingly destructive to trout, and were in fact depleting some of the trout streams. Such permits affecting only a small part of the range of the species involved have no serious effect on the total number of these birds.

It has been found that shrikes haunt the vicinity of bird-trapping stations where birds are caught for banding purposes and become exceedingly bold in attacking and killing birds that are

caught in the traps. For this reason the Secretary has issued a permit for the killing of shrikes in the vicinity of bird-banding stations.

In California the band-tailed pigeon under protection has increased greatly in numbers, and as a result of repeated complaints authority has been granted to growers of small fruits in that State and members of their families and bona fide employees to kill these birds during the daylight hours from May 15 to July 31 each year when destroying cherries. Permits for this privilege must first be countersigned by the executive officer of the State board of fish and game commissioners or his authorized representative.

It is believed that by permitting a reasonable control of birds inflicting serious damage to crops or other interests respect for the migratory bird treaty act will be more generally maintained.

#### VIOLATIONS OF THE ACT

Eight hundred and three migratory bird treaty act cases were pending before the courts at the beginning of the fiscal year, and during the year 573 new cases were submitted for prosecution. Of these 1,376 cases, 596 prosecutions resulted in convictions, 26 were nolle prossed, in 2 the grand jury did not return true bills, 132 were dismissed, in 61 the jury returned a verdict of not guilty, in 27 prosecution was barred by the statute of limitations, leave to file an information was denied in 35 cases, 4 were closed by reason of the death of the accused, 3 were stricken from the dockets with leave to reinstate, and in 1 case a demurrer to an information was sustained. In addition 1 libel proceeding against 31 strands of aigrettes that had been offered for sale and 2 against swans unlawfully possessed were decided favorably to the Government. The remaining cases are still pending.

The total revenue from fines collected during the year in all cases amounted to \$12 408.25, the fines ranging from \$475 to \$1 each. Defendants were also required to pay the costs in a number of cases, which in some instances equaled and in others exceeded the amount of the fine. About 96 other cases were reported by Federal wardens, which, on account of youthfulness of the accused, insufficient evidence, adequate fines having been imposed previously in State courts, or for various other reasons were not forwarded for prosecution. Violations of the State game laws being involved,



the evidence in many of these latter cases was transmitted to State game authorities for appropriate action. The revenue accruing to State game departments by reason of this cooperation was in excess of \$10,000.

Convictions in Federal courts were distributed as follows: Alabama, 10; Arkansas, 26; California, 1; District of Columbia, 5; Florida, 20; Georgia, 52; Idaho, 9; Illinois, 54; Indiana, 29; Iowa, 39; Kansas, 5; Kentucky, 2; Louisiana, 10; Maine, 15; Maryland, 10; Massachusetts, 6; Michigan, 4; Minnesota, 33; Mississippi, 5; Missouri, 58; Montana, 4; Nebraska, 6; Nevada, 1; New Hampshire, 2; New Jersey, 7; North Carolina, 14; Ohio, 4; Oklahoma, 2; Oregon, 32; Pennsylvania, 3; Rhode Island, 3; South Carolina, 1; South Dakota, 27; Tennessee, 18; Texas, 18; Utah, 6; Virginia, 42; Washington, 11; West Virginia, 2.

Two offenders in Iowa charged with killing ducks during the close season, in addition to paying a fine of \$300 each were required to serve 15 days in jail, while one violator arraigned in New Jersey for hunting wild ducks after sunset was sentenced on plea of guilty to 1 day in jail.

During the year migratory waterfowl plumage and specimens of mounted birds unlawfully killed or possessed, having a market value of about \$3,000, were seized. Most of the migratory-game birds seized were donated to public hospitals or to public charitable institutions for use as food.

Fines ranging from \$100 to \$25 were imposed against many offenders for possessing ducks in storage during the close season, offering to sell aigrettes, selling ducks, purchasing ducks, hunting ducks from motor boats, exceeding the daily bag limit on waterfowl, and for other miscellaneous offenses.

The sixth and seventh convictions in Federal courts for hunting wild fowl from an airplane were obtained in the eastern district of Oklahoma on June 11, 1924, when two persons were fined \$25 each for killing wild geese by this means; while the eighth conviction for similarly killing wild ducks was obtained in the Federal court for the western district of Washington on June 17, 1924, resulting in a like fine. Since the Federal law became effective 19 cases involving airplane hunting have been reported, 6 having been obtained during the past year, and of the whole number 8 resulted in convictions, as noted; in 2 true bills were not returned; 1 was dismissed, and 8 remain undisposed of.

The terrifying effect of airplanes upon wild fowl is so great that if any general use should be made of them in hunting the result would be exceedingly disastrous. Probably no other single method of pursuit of these birds could parallel their deadly effect in reducing the number of wild fowl. For this reason all sportsmen and conservationists interested in the maintenance of our supply should interest themselves in securing and forwarding to the bureau accurate information concerning such violations of the law. This cooperation will be of the very greatest practical value in helping protect our wild-fowl supply and is much needed, owing to the small number of wardens we have to cover such a vast territory.

Among other cases of interest terminated during the year may be mentioned 1 in the District of Columbia for purchasing wild ducks, resulting in a fine of \$125; 1 in Idaho for hunting ducks after sunset, fine \$50; 4 in Iowa for killing and possessing ducks in close season, fine \$100 each and costs; 1 in Maine, shipping partridges interstate in violation of State law and contrary to Federal regulations, \$200; 3 in Michigan, selling ducks, \$50 each; 4 in Minnesota, hunting ducks after sunset, \$50 each; 1 in Missouri, hunting coots from powerboat, \$100, and 1 for killing a duck in close season, \$100 and costs; 6 in North Carolina, hunting ducks at night, \$50 each; 1 in Rhode Island, killing sandpipers, \$45; 1 in South Carolina, killing wood ducks, \$50; 1 in Virginia, involving the shipment of more ducks than permitted in one week, \$475; 1 in Virginia, killing brant in excess of daily limit, \$50; and 1 in Washington, for offering to sell aigrettes, fine \$100.

#### SCIENTIFIC-COLLECTING AND OTHER PERMITS

There were issued during the year 1,079 permits to collect migratory birds and their nests and eggs for scientific purposes. Of this number 165 were new permits, and 914 were renewals of permits expiring December 31, 1923; 567 were general permits, authorizing the taking of specimens of all migratory birds, and 512 were limited, authorizing the taking of non-game and insectivorous birds, and shorebirds during the open season on yellowlegs and other species.

Scientific-possession permits numbering 199, mainly for the use of taxidermists, were issued, including renewals of 191 which expired De-



ember 31, 1923. Special permits were issued to 77 persons, authorizing them to possess and transport, but not to sell, specimens of migratory birds found dead or accidentally killed.

Permits issued during the year to trap birds for banding purposes numbered 988. These included 98 permits issued from July 1 to December 31, 1923, and 890 issued from January 1 to June 30, 1924. The 890 represent the actual number of persons holding permits to trap birds for this purpose at the end of the fiscal year. Of these, 242 are new cooperators, while 648 held permits in previous years. The value of bird banding as a means of gathering accurate information concerning the travels of migratory birds is becoming more and more apparent.

Permits to the number of 116 were issued during the year to authorize the capture of migratory waterfowl for propagating purposes and 2,360 permits were issued authorizing the possession, purchase, sale, and transportation of migratory waterfowl and their eggs for propagating purposes. This number is made up of 831 new permits and 1,529 renewals.

There was an increase of 65 scientific-collecting permits over those issued during the previous fiscal year and an increase of 141 in the permits to trap birds for banding purposes. Permits to capture waterfowl for propagating purposes, or to take the eggs of waterfowl, show an increase of 25, while the regular propagating (possession and sale) permits show a decrease of 1,178. This decrease is due to an amendment of the regulations on April 10, 1923, providing that persons may, without a Federal permit, possess and transport for their own use live migratory waterfowl that they might then legally possess or thereafter lawfully acquire. It is interesting to note, however, that this decrease is confined to persons who have held permits for some years and that as an offset 831 permits were issued in 1924 to persons who had not previously held them.

Beginning with January 1, 1924, all permits are valid until revoked by the Secretary, so that the routine work of issuing renewals each year will hereafter be obviated. This will materially reduce the volume of work which has heretofore been necessary in this connection each year. Correspondence incident to the permit work

has assumed larger proportions than heretofore, and has been much more difficult to handle because of the complicated questions involved. Infractions of the permit regulations have been few and of a minor character.

#### INTERSTATE COMMERCE IN GAME

No new Federal cases involving violations of the Lacey Act were reported for prosecution during the year, but of the cases previously reported, one terminated in a fine of \$5, and seven were dismissed. Fifty-eight investigations were closed as the shipments were either legally made or it was impossible to obtain evidence of illegality.

The bureau rendered many States valuable aid in reporting to them 209 apparent violations of game or fur laws and in furnishing evidence upon which to base State prosecutions. In 81 cases closed in State courts based on information furnished by the bureau or in which the bureau assisted in completing the evidence, fines totaling \$2,461.50 and costs amounting to \$269.20 were assessed. A jail sentence of 30 days imposed upon a violator in North Dakota was suspended. In another of these cases 145 muskrat skins were seized and confiscated by State authority. The work of the United States game wardens in detecting illegal shipments of furs from the States is meeting the approval of the fur trade, which is interested in the elimination of such practices from the industry.

#### INFORMATION CONCERNING GAME LAWS

The annual summaries of laws relating to game (Farmers' Bulletin No. 1375) and to fur animals (Farmers' Bulletin No. 1387) for the season 1923-24, and a directory for 1923 of officials and organizations concerned with the protection of birds and game (Department Circular No. 298) were issued during the year, and at the close of the year the "Game Laws for the Season 1924-25" (Farmers' Bulletin No. 1444) was in press. In July, 1923, and in June, 1924, there were issued the annual posters on "Open Seasons for Game" (No. 42, for the season 1923-24, and No. 43, for the season 1924-25). These publications aid in the administration of laws relating to the taking and transporting of game and the information assembled tends toward a gradual uniformity in laws in areas which are found to be climatically similar.

## HUNTING AND TRAPPING LICENSES

State laws requiring trappers of fur-bearing animals to take out licenses and to report on their catch, with closer regulation of the trapping period to the season when skins are prime, will be a great aid to maintaining the supply of fur bearers.

Returns from 27 States on the number of hunting licenses issued during the season of 1923-24 show an average increase of 2.5 per cent. If this ratio holds good throughout the country, as is believed to be the case, the number of licenses issued in 1923-24 should have totaled about 4,450,035, an increase of 108,537 over the previous year. The figures, by States, for the season 1922-23 are given in Table 735, on page 1198 of the Agricultural Yearbook for 1923.

## IMPORTATION OF FOREIGN BIRDS AND MAMMALS

The importation of foreign birds and mammals, while showing a considerable increase over that of previous years, has not yet reached the maximum attained in 1913, prior to the World War. The number of permits issued during the year was 741, an increase of 169, and the number of shipments inspected increased from 222 to 232. Six additional permits were issued for the entry of 26 miscellaneous birds at Honolulu, Hawaii. The total number of birds imported was 409,810, of which 30,150 were entered without permits.

The permits for mammals included 4,871 foxes from Canada, a considerable increase over the number authorized to enter during any of the three previous years, viz, 2,756 in 1923, 2,064 in 1922, and 1,574 in 1921. The total number of foxes authorized during the four years was 11,265. These were practically all for fur-farming purposes and indicate the growth of this new industry in the United States.

The most notable mammal entering the country during the year was a gorilla, which arrived in New York in April, the third ever brought alive to America. It was exhibited during the spring in one of the principal circuses. The last gorilla brought to the United States was on exhibition in the New York Zoological Park, but lived only a short time. Among other rare mammals was a drill and a Brazza monkey (*Lasiopyga brazza*), several baboons and other African monkeys, and 11 different species of kangaroos, the latter entered in a single shipment from Australia.

New York and San Francisco still continue to be the principal ports of entry. Comparatively few entries are made at Boston, Philadelphia, or New Orleans. On the southern border, Brownsville, Laredo, and Eagle Pass, Tex., are the chief ports of entry of Mexican quail and parrots; Vanceboro, Me., and Detroit and Port Huron, Mich., for foxes from Canada; and Portal, N. Dak., and Buffalo, N. Y., for entries from western Canada.

On the Pacific coast there has been a marked increase in the receipts at Seattle and an equally marked decrease in the number of birds entered at San Francisco, where formerly large numbers of certain birds from the Orient, as Java sparrows, sociable finches, zebra finches, and other species of small value were imported. Comparatively few of these species are now brought in, presumably on account of the duty, although some birds of the same species are still imported by way of Europe through the port of New York.

Importations of game birds included 28,388 Mexican quail and 4,196 Hungarian partridges, but otherwise were small and comparatively unimportant, being chiefly a few bamboo partridges, pheasants, and waterfowl. The shipments of Hungarian partridges represented only about 11 per cent of the number brought in during 1914, when the interest in these birds was at its height. This year the birds were distributed to five States, two in the East and three in the West: Connecticut received 500; New Jersey, 1,380; Colorado, 420; Montana, 1,700; and Nevada, 100. It is noticeable that none of these States received any considerable number of quail, while those which were most anxious to secure quail were apparently not interested in restocking with Hungarian partridges.

About 1907 many of the State game administrations became interested in the Hungarian partridge. Importations were made during subsequent years both in this country and in Canada. Up to the present time all efforts to acclimatize these birds in the eastern part of the United States appear to have been failures, but on the other hand good success has been attained in eastern Oregon and Washington, and also in Saskatchewan and Alberta, Canada. This has encouraged the introduction of these birds in Nevada, Idaho, and Montana, the results of which are awaited with great interest.

Very few pheasants of any kind were imported—only a single shipment



of 100 ringnecks from England and a few aviary birds, including Reeves, Swinhoe, and Lady Amherst pheasants. As mentioned in the report last year, the importation of pheasants has not recovered since the war, and the stock of aviary birds is low compared with pre-war conditions. In fact, several species then represented in the larger collections probably no longer exist in the United States. Shipments of waterfowl were confined mainly to ornamental species imported for park or exhibition purposes.

Ten permits were issued for the entry of 204 eggs of game birds; the shipments covered by these permits were nearly all from one point in Alberta, Canada, and comprised chiefly eggs of ruffed grouse, sharp-tailed grouse, and canvasback ducks.

The principal cage birds imported, as usual, have been canaries and parrots, of which the canaries numbered 310,379 and the parrots 45,817. Among the parrots the most notable importations included considerable numbers of Cuban parrots and Australian shell parakeets. Although neither of these birds were entered in as large numbers as before the war, the Cuban parrots numbered about 2,400 and the shell parakeets more than 10,000. A number of rare species were represented in the entries, among which may be mentioned 2 keas from New Zealand; the Le Vaillant parrot (*Pocephalus gularis*) from Africa; the Bodin amazon (*Amazona bodini*) and the red-fronted Amazon (*A. salvini*) from tropical America; a short-tailed parrot (*Graydidascalus brachyurus*) from Brazil; 70 Pennant parakeets (*Platyercus elegans*) from Australia, and South American parakeets, including several hundred chocolate-faced parakeets (*Conurus aeruginosus*) from Venezuela; and 30 cactus parakeets (*C. cactorum*) and 47 half-moon parakeets (*C. aureus*) from Brazil.

Among other rare birds were 2 kiwis from New Zealand; 6 wood hoopoes (*Irrisor erythrorhynchus*); 5 giant whydahs (*Diatropura prognis*); 2 great ground hornbills (*Dichoceros bicornis*); 6 verditer flycatchers (*Stoparola melanops*); 6 Abyssinian starlings (*Spreo superbus*); and 400 bleeding-heart doves from the Philippines, the first large consignment of these doves which has been received for several years.

The tariff act of 1922 places an import duty of 50 cents each on all cage birds brought in valued at not more than \$5 and 20 per cent ad valorem

on birds of higher value. As a result there has been a marked falling off in the importation of weaver birds, particularly of Java sparrows, nuns of the genus *Munia*, strawberry finches, zebra finches, cordon bleus, and sociable finches. Such large numbers of low-priced species as were formerly imported are no longer brought in, although a few representatives of all of these forms are entered from time to time.

Traffic in certain native cage birds, as mockingbirds, cardinals, and other attractive song birds from Mexico, has formed the subject of frequent inquiries recently, owing to the general restriction on the possession and sale of these birds under State laws. Although possession may be authorized in some States, shipments of these birds are frequently resold, and thus find their way into States where the birds may be offered for sale inadvertently or otherwise contrary to local laws. Dealers and other purchasers in order to avoid possible difficulties should first learn the limitations, if any, concerning the possession of such birds under the State game laws.

#### IMPORTATION OF QUAIL FROM MEXICO

The entry of quail from Mexico last season was on an entirely different basis from that in any previous year, owing to the fact that the Mexican authorities required permits for the export of the birds, and these permits were issued only to a few authorized exporters and for limited numbers of birds. The cooperation of the Biological Survey was requested to see that the quota was not exceeded in importations at the border.

The total number of quail imported was 28,388, the largest number ever entered in any season except in 1922, when 37,953 were brought in. Most of the birds were entered at Brownsville, 1,993 at Laredo, and 4,794 at Eagle Pass. Importations began later and closed earlier than usual. Although the season extended from November 15 until April 30, both dates inclusive, the first shipment did not arrive until February 18 and the last shipments on April 21, so that the season of importations was only about two months. As usual, the consignments were examined at the port of entry, but no quail disease was reported during the season. The bulk of the birds were shipped to six States: New York, 3,032; Pennsylvania, 7,227; Maryland, 2,468; Kentucky, 5,158; Oklahoma, 5,383; and Texas, 3,176; and



the remainder—1,944—in small numbers to a dozen other States.

Quail have been regularly imported from Mexico for about 15 years, and the total number brought in up to date is 189,859. Most of these have been shipped to less than a dozen States—Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Maryland, Virginia, Ohio, Kentucky, Oklahoma, and Texas. The States which received 20,000 or more between 1921 and 1924 are Pennsylvania, Maryland, Kentucky, and Ohio.

A cooperative survey of the situation south of the Rio Grande, by Mexican authorities and the Biological Survey, has been proposed as a basis for collecting data to govern further importations. Under the system in force this year not only is the number of birds inadequate to meet the demand but much dissatisfaction and criticism was voiced in States which are unable to obtain the birds at the time and in the quantities they desire. This year for the first time under the system of export permits, the number consigned to each State was limited, but the apportionment was not always satisfactory, some States being able to obtain considerably more than others.

The system followed by the Biological Survey in the last few seasons

of prompt inspection and passage across the border of importations of Mexican quail has resulted in greatly reducing the losses from disease among these birds, both during shipment and after their arrival at their destination. Furthermore, experience has proved that the importation and liberation of these birds during the spring months results in far greater success than efforts to bring them north earlier in the winter, when they must be held for long periods in confinement.

#### **PUBLICATIONS AND INFORMATIONAL WORK**

In addition to the publications prepared in the Biological Survey and issued during the year, or in press at the close of the year, there have been prepared in the bureau, or edited and authorized, many items for press distribution and a number of articles for scientific and popular periodicals dealing with timely activities of the bureau. Numerous photographic prints also have been selected and made from official negatives as requested to illustrate these and special articles by individual writers and for photogravure sections of the public press.









JAN 3 1925

EXPERIMENT STATION

## REPORT OF THE CHEMIST

UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF CHEMISTRY,  
Washington, D. C., September 15, 1924.

SIR: I beg to submit herewith the report of the work of the Bureau of Chemistry for the fiscal year ended June 30, 1924.

Respectfully,

C. A. BROWNE, *Chief.*

Hon. HENRY C. WALLACE,  
*Secretary of Agriculture.*

The present chief of the Bureau of Chemistry took over the direction of its work on October 1, 1923. His return to a former field of activity after 16 years of absence in a commercial position has caused him to observe a number of changes not only in the general status of agricultural chemistry as a science, but also in the relationship of chemistry to the Department of Agriculture as a whole.

The aims of agricultural chemistry, as defined by the pioneers of the science in Europe and America three-quarters of a century ago, were the relatively simple ones of determining the chemical elements which were necessary for the growth of crops, of ascertaining the forms in which these elements could be most economically supplied, and of devising methods of analyses for preventing the commercial substitution of worthless or inferior fertilizing substances. The early demarcation of agricultural chemistry into the two fields of research and regulatory work was thus distinctly drawn. Moreover, the aims and methods of the science as thus laid down were purely chemical. The immense benefit which resulted from the establishment of the great artificial fertilizer industry caused chemistry to be regarded as the science of pre-eminent value to agriculture. Chemists wrote leading works on agriculture, and chemists were usually appointed to the directorships of the agricultural experiment stations.

The conditions which obtained in this first or crop-feeding era of agri-

cultural chemistry prevailed to a somewhat less extent in the second or stock-feeding period of the science. Chemistry was called upon to determine the food constituents which were necessary for the growth of farm animals, to ascertain the forms in which these constituents could be most economically supplied, and to devise methods of analyses for preventing the commercial substitution of worthless or inferior feeding materials. The same twofold division of the science into research and regulatory lines of activity prevailed in this second stage of development. There was here, as before, a definite practical problem which awaited solution—in the first case, the maximum production of crops; in the second case, the maximum yield of animal products, such as meat or milk. If the aims and methods of research were less chemical in the second case it was not a difference of kind but only of degree, and chemists maintained their leadership in the field of stock-feeding as in that of soil and fertilizer investigation.

It was a curious anomaly that the third and most important period of agricultural-chemical research—that pertaining to investigations upon human food—should have come last. Serious attention has been given to this field only within the last 30 years. In its work of determining what nutritive constituents are necessary for the best development of man, of ascertaining the forms in which these constituents can be most economically sup-

plied, and of devising methods of analysis for preventing the commercial substitution of worthless or inferior articles of diet, agricultural chemistry continued to perform its double research and regulatory function. A definite practical problem, such as claimed the general attention of chemists in each of the first two periods of the science, was, however, lacking in this third, more diversified period of agricultural-chemical research. It also began to be realized, as never before, that the final aims of agricultural research were no more chemical than physical or biological, and that the various sciences in their relationship to agriculture were simply the means to an end. In thus ceasing to exercise the directing part in agricultural research, however, chemistry has not contracted but has enlarged its sphere of action. It is in that borderland where chemistry touches upon physics, biology, physiology, and the other sciences that chemical research is performing to-day its greatest service to agriculture. This requires for the best results a state of most active cooperation upon the part of every science, instead of the former attitude of independent aloofness.

It was but natural that this gradual transition in the general relations of chemistry to agriculture from a directing to a cooperating science should have been reflected by a similar change in the scientific organization of the bureaus of the Federal department. The division of chemistry, as originally conceived and developed, was an agency in which all the chemical work of the Government should be performed. With the rapid expansion of scientific work in the different departmental bureaus, however, this plan became too extensive for practical continuance. An increasing need for chemists was felt in every branch of Governmental service, with the result that chemical work on contract supplies, soils, road materials, forestry products, dairy products, meat products, and other commodities, which had been initiated by the Bureau of Chemistry, was gradually taken over by Federal agencies that were specifically charged with the investigation of these materials. Because of this, together with the responsibility conferred upon it by Congress for the enforcement of the food and drugs act, the Bureau of Chemistry has concentrated its attention increasingly on the research and regulatory work connected with foods and drugs.

## RESEARCH WORK

The Bureau of Chemistry conducts researches on the chemical composition of agricultural and related products, on the technical methods of their production and on the industrial uses to which they are put. Practical applications of the bureau's researches are made toward developing methods for improving the chemical composition and quality of agricultural crops, toward finding means for preventing the enormous losses which occur annually from deterioration, dust explosions, and other causes, toward devising processes for the profitable utilization of waste and surplus crops, and toward improving existing methods of manufacture in industries which employ agricultural products as raw material in order to create for such products a wider and more stable market.

The bureau's extensive researches on the composition, manufacture, and sophistication of foods, drugs, beverages, rosin, turpentine, insecticides, disinfectants, etc., are also practically applied in preventing the adulteration and misbranding of these products through the enforcement of the Federal food and drugs act, the naval stores act, the tea inspection act, and the insecticide and fungicide act. The regulatory and research operations of the Bureau of Chemistry are so closely allied that an intimate contact between the two must be maintained for the most successful performance of its various activities. The regulatory contacts with industry, through chemists and inspectors, furnish the scientific staff of the bureau with an important means, unavailable to other Governmental agencies, of suggesting and devising methods for improving the quality of foods, drugs, naval stores, insecticides, etc., and of introducing economies in their manufacture. Moreover, the Bureau of Chemistry has acquired through its regulatory service a vast amount of detailed information, in the form of correspondence, testimony, and reports, that is of the greatest assistance to research, which it stimulates and prevents from going astray into lines that are visionary and unproductive. This unpublished material, which is constantly increasing in volume, is a most valuable asset upon which bureau investigators may constantly draw in the preparation of announcements and publications.

One of the most pressing economic problems now awaiting solution in



agricultural-chemical research is the reduction of the enormous losses that occur from the deterioration of fruits, vegetables, grain, sugars, sirups, and other foods. Closely related to this problem of deterioration is that of the spontaneous combustion of agricultural products. Reports by the National Board of Fire Underwriters show that during the period 1918 to 1921 the adjusted fire losses attributed to spontaneous combustion on farms in the United States amounted to \$4,196,386. This does not include the far greater loss from the spoilage of farm products due to spontaneous heating, where there was no combustion, and for which there would be no fire-loss adjustment. In 1921 the total losses from spontaneous combustion in the United States amounted to \$20,186,392, this ranking as the second largest known cause of fire loss on the list. Among the lines of industry which suffer from this cause are many that handle agricultural products, more particularly the manufacturers and shippers of dairy feeds. A study of the losses which occur from the deterioration and spontaneous combustion of agricultural products is being conducted by the bureau in so far as the limited available funds permit.

Several changes have been made during the year in the organization of the bureau to effect a closer combination of the units which are engaged in related work. The Pharmacognosy Laboratory was discontinued as a separate unit, some of the work formerly done in this division being transferred to the Drug Control Laboratory. Similarly, the work of the Animal Physiological Laboratory was combined with that of the Protein Laboratory. The Fruit and Vegetable Utilization Laboratory was abolished, its work on the manufacture of maltose sugar being transferred to the Carbohydrate Laboratory. These combinations of related lines of activity will effect not only a greater economy of operation, but an increase in the efficiency of the bureau's work.

#### CROP CHEMISTRY

How to improve the quality of wheat, corn, and other crops by increasing their protein and mineral content is a problem which the Bureau of Chemistry is endeavoring to solve by means of chemical investigation. The chief constituents that give nutritive value to a food are proteins,

fats, carbohydrates, mineral salts, and vitamins.

Progress was made during the year in the work on increasing the protein content of wheat. Wheat high in protein has greater nutritive value and the flour from it better baking qualities than wheat with lower protein content. As a rule, consumers will pay a higher price for a product of superior quality. Much wheat is now bought for the baking industries on the basis of its protein content, and when climatic conditions in a particular wheat-growing region during a given season cause the crop to be low in protein, the buyers for the baking industry go elsewhere for grain with a higher protein content. Moreover, improvement in quality seems likely to create a greater demand for American wheat in the world market. Information as to how to increase the protein content of the grain is therefore of direct, practical value to wheat growers as well as to consumers.

Experimental work has shown that the application of a nitrate fertilizer at about the time the grain is beginning to head materially increases the protein content of wheat. Data fixing more precisely than heretofore the exact stage of growth at which the application of a nitrate produces the maximum increase in the protein content are being obtained from experiments during the current season. How to apply such fertilizer to the growing crop in the best practical manner is being studied, as well as the effect of cultivation on the protein content of the wheat. Sufficient progress has been made to show that leaving space for entering the wheat field and applying fertilizer at advanced-growth stages does not decrease the yield for a given area, and may even increase the yield as well as improve the quality of the grain.

Guided by experience gained in the study of wheat, an investigation of the possibility of increasing the protein content of corn has been started. Corn is low in protein, and nutrition studies have shown that what protein is present is of poor quality, needing supplemental proteins from other sources. Any method that can be devised to increase either the quantity or the quality of the protein in corn will therefore proportionately increase the nutritive and economic value of the corn crop. Attention is also being given to cornstalks, used extensively for animal feeding in the form of silage, with the object of discover-

ing the most economical method of increasing their nutritive value.

A diet which fails to furnish mineral salts in adequate variety and quantity gives rise to diet-deficiency diseases. Two of the most important constituents in nutrition are iron and iodine. Investigations are now being planned to study means of increasing the iron content of such green vegetables as furnish the most important supply of these elements in human food.

The application of chemistry to the improvement of food plants is thus yielding results of real practical value. Progress in this work, however, depends upon basic research in the chemical composition of crops, the composition and action of fertilizers and soils, and the observation over a period of years of the effects of variations in soil, fertilizers, methods of cultivation, and other environmental factors on the chemical constituents. Such basic research must precede any intelligent attempt to improve the composition of food crops.

An investigation is under way on soil reaction (acidity or alkalinity) and its relation to the composition and yield of crops. The importance of the reaction in all biochemical studies is now widely appreciated, and its significance in the growth of crop plants is constantly receiving greater recognition. The methods which have been proposed for determining the reaction and the methods of stating the results so that they will be intelligible to the nonspecialist are being critically studied. It is hoped that work now in progress will lead to the development of methods which can be applied practically in the field by the farmer. Experiments have been started to ascertain the reaction best suited to individual crop plants, so that after the farmer has determined the reaction of his soils, he can find out what crops can be most successfully grown without the addition of lime or sulphur to change the reaction, or, if circumstances make a choice of crops impracticable, to what extent these reaction-modifying agents must be added to bring the reaction toward that best suited to the crop he finds it necessary to grow.

#### PROTEIN INVESTIGATIONS

A few years ago it was thought that a given quantity of protein from one source was equal in nutritive value to the same quantity of protein from any other source. Researches

in recent years have shown that proteins of different origin vary materially in chemical composition, some proteins being deficient in certain amino acids essential to proper nutrition. When foods containing proteins of such deficiency are fed to growing animals as the sole source of their protein, the animals will cease to increase in weight, even though the diet is otherwise adequate. When either young or mature animals receive such foods for continued periods they will die. In determining what foods will furnish an adequate protein supply for both human beings and animals it is essential to know the chemical composition of the proteins of the various foods. This requires extended and exceedingly difficult research work.

Previous work had shown that while the chief protein of corn is lacking or deficient in some of the essential amino acids, the addition to corn of certain concentrates which contain the missing amino acids will produce a mixture that will be satisfactory for the normal growth and development of animals. Concentrates which the work has shown to be effective as supplements to corn include peanut meal, soybean meal, coconut press cake, and tomato-seed press cake. An article published during the year in the *Journal of Agricultural Research* gives the proportions of a concentrate which was used with corn and found satisfactory.

Feeding experiments with albino rats on the proteins of the lentil have shown that this is deficient in the amino acid cystine. Young animals when fed a diet the sole source of protein in which is derived from the lentil decline rapidly and die in about two weeks. When to this diet is added 0.36 per cent of cystine, growth at almost the normal rate is obtained. Experiments to determine the vitamin content of this seed have shown that when it constitutes 25 per cent of the diet it furnishes sufficient vitamin B and nearly enough vitamin A, but that 12½ per cent of this seed does not furnish enough vitamins. The lentil proteins share with the bean proteins, although to a smaller degree, a form of indigestibility which can be corrected by cooking.

The published digestibility figures for the proteins of the cottonseed are lower than those established for some of the good proteins, such as casein. Since it is known that certain toxic substances frequently inhibit the action of digestive enzymes, it was



thought that the toxin gossypol which is present in cottonseed might account for the low digestibility of cottonseed proteins as reported. These digestion experiments were conducted on pure, isolated cottonseed globulin. It was found that the pure cottonseed globulin was fully as digestible as casein, but that the addition of 1 per cent of gossypol produced a marked lowering of the digestibility of this protein. A like decrease in the digestibility of casein was produced by the addition of 1 per cent of gossypol.

Progress was made on the study of the proteins of wheat bran as reported last year. By a special treatment, bran practically free from other parts of the kernel has been obtained, and in such a form it can be ground to pass through a 100-mesh sieve. From this meal nearly 66 per cent of the total protein in the bran has been isolated and identified. The proteins isolated consist of albumin (17 per cent), globulin (14 per cent), and alcohol-soluble protein (33 per cent). Further work on the proteins of wheat bran is under way.

Feeding experiments with young rats showed that the proteins of palm-kernel meal were adequate for the normal growth of the rats, in so far as protein alone is concerned, but they contained no appreciable quantities of vitamin A or vitamin B. Since the meal used for these experiments was a commercial product obtained as a residue from the nuts after the removal of the oil by the solvent process, these results with reference to vitamin content may not apply to the fresh, untreated palm-kernel nut.

Work to determine the effect of long-continued storage at a low temperature on the vitamin A content of eggs has now been completed. Very little difference was found between the vitamin A content of fresh eggs and that of eggs which had been in storage for nine years in a frozen condition, showing that no serious deterioration of the vitamin had taken place during the long storage of the eggs at a temperature ranging from below 0° F. to 10° F.

Until recently there have been no methods whereby the tryptophane and cystine content of proteins could be accurately ascertained. Quantitative figures for these two amino acids are therefore lacking in most tables giving the amino acid composition of proteins. Since tryptophane and cystine are indispensable for the normal nutrition of animals, it is important to have information on the quantities of

these two amino acids in the proteins of foods and feedstuffs. More than 100 proteins from important food materials have been examined and their content of these two amino acids has been determined by methods recently published.

Work to determine the nutritive properties of oysters, clams, and shrimp has been started. It is planned to study them from the standpoint of their protein and vitamin value, and to determine the amino acid composition of their proteins by chemical analyses and feeding experiments.

#### ODOROUS PRINCIPLES OF THE COTTON PLANT

It is well known that for many years enormous destruction has been caused to the cotton crop by the depredations of the boll weevil and that this entails an annual loss of many millions of dollars. The numerous attempts which thus far have been made to prevent the destruction caused by this insect have, however, resulted only in a mitigation of the evil, and each year the application of some poisonous compound has been necessary in order to prevent a complete loss of the cotton crop.

Inasmuch as the cotton plant possesses some specific attraction for the weevil, it is presumed that this may be due to some odorous substances emitted by it. In cooperation with the Bureau of Entomology, an investigation was accordingly undertaken to determine the nature of these odorous substances. The preliminary work was conducted at Tallulah, La., during the summer of 1923, when several thousand pounds of the cotton plant were distilled. The products obtained by this method since then have been subjected to chemical investigation in the laboratory at Washington, and they have been found to be of an exceedingly complex nature. The separation and identification of the individual constituents has consequently been a very difficult task, but it is gratifying to report that the work in this direction has been attended with a considerable measure of success. Some very interesting observations have been made in this connection, and one of the compounds obtained, which can be prepared synthetically, will now be available for chemotropic tests. If this compound should prove to possess the desired attractive properties, it can be produced at a cost which would permit of its practical application. It is anticipated that



the chemical investigation of the odorous constituents of the plant can be completed during the present year, and when this is accomplished a complete account of the results will be presented, together with such deductions of practical import as may be made from them.

### VEGETABLE OILS

Further progress in the manufacture and utilization of cottonseed, corn, peanut, sesame, and other vegetable oils depends upon a more complete knowledge of the raw and finished products. After cottonseed oil had been a commercial commodity for 50 years or more and scientists had studied it for many years, accurate information concerning the constituents in the crude oil was still lacking. Realizing that the complex composition of cottonseed and other fatty oils would make it impossible for works' chemists to obtain much more information about them, manufacturers asked the aid of the Department of Agriculture in solving their fundamental problems.

The determination of all the constituents of crude cottonseed oil was assigned to the Bureau of Chemistry. To date it has been shown that this oil contains proteoses, peptones, pentosans, raffinose, resin, and various phosphatides, including what is believed to be inosite phosphates in combination with calcium and magnesium. Evidence has been obtained that xanthophyll is also present.

It has been shown that the phosphatides, resin, etc. readily emulsify the oil with water and that they are partly the cause of the retention of neutral oil by the soap stock in the caustic soda refining process. The nature and proportion of saturated and unsaturated acids present as free fatty acids has been determined in both crude cottonseed and peanut oils. A method for the determination of the total quantity of neutral oil in a crude oil has been perfected, so that it is now possible to estimate the quantity of oil in any crude oil as accurately as iron or other metal in an ore may be estimated. This method is already in use in several laboratories for the examination of crude oils and for the determination of neutral oil in soap stock. It is probable that crude oil will be purchased in the future on the basis of the oil present as determined by this method.

An investigation of the composition of sesame oil has been completed. Al-

though it has been an important commercial oil in Europe and Asia for many years, large quantities have become available in the United States only recently, through the importation of seed and oil from China. The oil is used for both edible and technical purposes.

It is believed that the work on the study of oils now under way will aid in developing a more profitable utilization of vegetable oils, with benefit to producers, manufacturers, and consumers. The value of domestic vegetable oils to the industry of our country is indicated by the following statistics of production in 1923 of a few of the leading oils: Approximately 110,000,000 pounds of corn oil; 165,000,000 pounds of linseed oil; and 1,016,000,000 pounds of cottonseed oil.

### FRUIT AND VEGETABLE UTILIZATION

Work to improve the methods used in preparing raisins from California Sultana grapes is under way. These raisins are sold in Europe where they come into competition with the same variety of raisins produced in Asia Minor which command a premium in the market because of their lighter color. The object of this work is to devise means of drying the California Sultanas in such a way that they may compete in color with the Asiatic product.

The standardization of raisins is also receiving attention. Raisins have been standardized heretofore in an arbitrary way, no mechanical or other device being used. It is now desired to substitute mechanical means of standardization, and, as far as possible, eliminate the personal equation which often gives unsatisfactory results. It is proposed to ascertain what part the moisture, sugar, acid, and insoluble solids play in the standardization of raisins, and to attempt to grade raisins mechanically for size and for defective berries.

The investigations on the composition of California citrus oils have been continued. Some experimental work on candying citron has been done. Grapefruit juice of excellent quality made by methods worked out in the Bureau of Chemistry is now being marketed. The results of the work on citrus pectin are in course of publication.

A method devised for the use of ethylene in the coloring of mature citrus fruit is rapidly coming into general use in California. Hundreds of carloads of oranges and lemons have been colored during the year

by the process. This has many advantages over the kerosene-stove method previously used. Some means for coloring citrus fruit is necessary because certain varieties are green in color when fully mature. As a rule, consumers judge the maturity of oranges and lemons mainly by the color and will not buy green-colored fruit, even though it is fully mature. The coloring of immature citrus fruit to give it the appearance of ripe fruit is prohibited under the terms of the Federal food and drugs act.

The ethylene method is more convenient than the old stove method, it offers less fire risk, it does not need constant supervision, it does away with the danger of smutting the fruit with smoky stoves, it imparts no odor to the finished product, and, during the warm season, it causes no wilting and shrinking of the fruit, as is the case when stoves are used. The ethylene method can be rigidly standardized with respect to temperatures, humidities, and gas concentrations in a manner productive of uniform results.

Work was continued on a study of the effect of freezing on the composition of oranges and lemons.

The investigational work on the development of improved methods for dehydrating fruits and vegetables has been terminated, and the results of the completed work have been assembled for publication.

Extensive correspondence during the past 5 years on the problems involved in the manufacture of vinegar in the home has led to the preparation of Farmers' Bulletin 1424, entitled "Making Vinegar in the Home and on the Farm," issued in June, 1924. It has been shown repeatedly that the home manufacture of vinegar offers a method of saving quantities of fruit which would otherwise be lost on account of the inadequacy of the local market or the failure of the fruit to reach market quality. It is entirely practicable, however, to salvage this material to supply the needs for vinegar in the home and possibly even to supply the local market.

The manufacture of sauerkraut offers a favorable means for marketing large quantities of cabbage. This industry is already fairly well established in some parts of the country where cabbage production is practicable on a commercial scale. After studying the problems involved in the manufacture of sauerkraut for a period of years, the bureau is now

preparing directions for its commercial production.

For many years products other than cucumbers and cabbage have been pickled on a small scale commercially. Many inquiries on the possibility of pickling these products in the home have been received during the past few years. To obtain tangible information, a series of experiments on the pickling of martynias, mango melons, burr gherkins, onions, peppers, string beans, green tomatoes, and cauliflower were performed in 1923. All of these products appear in commercial brands of mixed pickles. The results showed that the brining of onions, mango melons, peppers, burr gherkins, and cauliflower is practical and desirable. The brining of martynias, string beans, and tomatoes is possible, but the resulting pickles are not generally useful, because long standing in strong and acid brine injures the flavor and texture which make the fresh product attractive.

#### PROCESS FOR MAKING MALTOSE SUGAR

A new process for making crystalline maltose sugar from cornstarch or from corn hominy or other starch materials was completed. That it is possible to make crystalline maltose sugar from cornstarch has been known to chemists for many years, but control of the process has been lacking, and it has not been possible heretofore to produce crystalline maltose sugar from starch economically. The new method enables the chemist to control the process so that it proceeds with regularity and certainty. The process is simple and involves no unusual equipment. The final cost will be lower than the cost of making cane sugar.

While the process for making maltose sugar is simple, it will not be practicable for the farmer to make the product for family use from his own corn, as the method requires technical control similar to that necessary in making sugar from beets or cane. The new product is obtained in the form of fondantlike masses and not in a granulated form like granulated cane or beet sugar. It can be melted and cast in molds like fondant made from cane or beet sugar. It may be used in the candy industry in producing chocolate-cream centers and other cream confections.

The process consists essentially of mashing either cornstarch or corn hominy with malt, which liquefies the product and in the course of from 7



to 10 days completely converts the starch into maltose sugar. After decolorizing with carbon and evaporating to a given density, the sirup is allowed to cool. It is then inoculated with a little crystalline maltose and allowed to stand from one to several days at room temperature, when it sets into the solid crystalline fondant, the crystals being so fine that they can be distinguished only under a high-power microscope.

As this new advance in producing crystalline masses of maltose sugar from corn has yet to be industrialized, it is too early to realize its bearing on the utilization of corn. The investigational work is not entirely complete, but it has proceeded far enough to show that it is practicable to make an excellent grade of crystalline maltose sugar from corn-starch or hominy.

#### TANNING AND LEATHER INVESTIGATIONS

Chestnut wood furnishes approximately 75 per cent of our domestic supply of vegetable tanning materials. Because of the rapid destruction of the chestnut tree by the blight, the leather industry will soon require new sources of tannin, for which reason it is considering the introduction and propagation in this country of foreign tannin-bearing trees and plants. In this connection information has been collected on watties, some of which in South Africa and Australia produce an excellent tan-bark. In cooperation with the blight investigations of the department, examination and analysis have been made of wood and bark from chestnut trees showing different degrees of blight resistance.

Possible sources of tannin among our domestic materials are being investigated. During the past year a number of domestic materials have been analyzed for tannin. Eucalyptus bark and certain redwood samples were found to contain from 5 to 8 per cent tannin. One sample of screened crystals from redwood cones showed 76 per cent tannin, and an unscreened sample showed 55 per cent. These results confirm the results of a previous analysis of a powder from sequoia cones which showed 73 per cent tannin. The tannin seems to be almost entirely of the catechol class, and is accompanied by much objectionable red coloring matter. It is believed that large quantities of the cones will be available in a few years

if reforestation programs are carried out.

Investigations were continued on the properties and uses of leather and leather substitutes, and of leather dressing, finishing, and treating materials, in order to assist in developing methods and materials for producing longer wearing leathers and leathers better suited for specific purposes. The results of an elaborate wear experiment conducted with soldiers' shoes have been published as Department Bulletin 1168, "Wearing Qualities of Shoe Leathers." The first edition was soon exhausted and a revised edition issued. The bulletin has been reprinted in two American trade journals and in one English journal.

A third reprint of Farmers' Bulletin 1183, "The Care of Leather," was necessary during the year. About 110,000 copies had already been issued. This bulletin gives practical directions for the treatment of boots, shoes, harness, belts, and other articles made of leather in order to prolong their life.

Additional analyses have been made of old deteriorated leather bindings in a study of the causes of deterioration of leather. The significant results will be published. Since light is believed to be one of the causes of deterioration of leather, an experiment on about 600 pieces of leather from goatskin, sheepskin, and cowhide exposed to different light effects has been started. The results of this experiment will be of scientific interest and of practical value.

During the year work was done on the development of a roach-resistant book cloth, including experiments with approximately 100 chemicals and mixtures. Promising results, which are being further developed, have been obtained.

A treatment for the production of waterproof fiber counters has been developed and is now being tried out in actual service by a large shoe manufacturer.

The methods of analysis of tanning materials and of leather have been thoroughly revised. An improved method for the determination of sugar in leather has been developed, published, and recommended for adoption by the American Leather Chemists' Association. A procedure whereby moisture in leather can be determined with much greater accuracy than by the methods now in use has been developed and is being subjected to further and more rigid trial. Cooperative work with the American Leather



Chemists Association has been done on the development of methods for the analysis of chrome leather, on the effect of hydrogen-ion concentration upon the hide-powder method of determining tannin, and on comparative tannin analyses. Work was done on the determination of water solubles in leather, on the Wilson-Kern method of determining tannin, on the age effect of chrome-alum solutions used in the hide-powder method, and on modifications of the time, concentration, and quantity of hide powder as affecting the hide-powder method for determining tannin.

Farmers' Bulletin 1334, "Home Tanning of Leather and Small Fur Skins," was reprinted during the year, the first edition of 30,000 copies having been soon exhausted.

#### WATERPROOFING, MILDEWPROOFING, AND FIREPROOFING FARM FABRICS

Tobacco shade cloth, varying in cost from \$200 to \$350 per acre, is a large item in the cost of growing wrapper-leaf tobacco. From 10,000 to 12,000 acres of tobacco are grown under shade cloth. In the Connecticut Valley, where most of this material is used, it must be purchased every year, because after one season's use it is so weak that it will not resist the strain of windstorms, which are frequent during the growing season. While some cloth is used a second season for the sides of the tents and some is sold for a second season's use over slats in Florida, the net cost of annual replacement is high. Mildew is not troublesome in the Connecticut Valley, and it is generally agreed that the deterioration of tobacco shade cloth there does not result from this cause. From the results of our previous work in connection with waterproofing, it is believed that the deterioration is due almost entirely to the injurious effect of sunlight.

In order to develop a treatment which would make tobacco shade cloth serviceable for two and possibly three seasons instead of one, experimental treatments were applied last year to four 250-square-yard pieces of tobacco shade cloth for service tests in Connecticut, and to about thirty 2-square-yard pieces for exposure tests near Washington. Since most of these treatments color the fabric, the effect of the various colors upon the growth of the tobacco must also be taken into consideration in deciding upon a suitable treatment. After the first season's exposure, three of the large pieces and several of the small pieces

subjected to experimental treatment were decidedly stronger than untreated cloth similarly exposed. There was no noticeable effect upon the growth of the tobacco from the use of colored cloth in these small-scale experiments. All but the least effective of the treated samples are being exposed for a second season.

There is great need for a practical fireproofing treatment for tobacco shade cloth and for other fabrics used out of doors for agricultural purposes, not only to preserve the fabrics, but also to reduce losses from fire to crops, supplies, machinery, and livestock.

A survey has been made of all fireproofing processes and a search has been made for a process that would be applicable to outside farm fabrics. Several satisfactory processes are now available for fabrics not exposed to wetting and one process resists wetting, but, because of its high cost, it is limited to clothing or other high-priced and light-weight fabrics. No treatment suitable for tobacco shade cloth or canvas for outside use has yet been found. The search for a suitable fireproofing treatment for outside farm fabrics is being continued.

#### FRUIT AND VEGETABLE WRAPPERS

The use of paper to protect fruits and vegetables from the time they leave the producers' hands until they reach the consumer is increasing at a rapid rate. Suitable paper wrappers afford not only an effective means for advertising but several other distinct advantages. They retard evaporation of moisture and thus tend to keep fruits and vegetables in a fresh condition; they reduce the damage in shipment from rubbing or jarring; they form a barrier to outside bacterial and mold infections that cause decay; they retard final ripening until removed by the retailer; they keep out dust and dirt; and they tend to equalize the temperature, protecting from frost when the temperature is near freezing. It can not be expected that all these effects in the highest degree can be obtained with one kind of paper, nor can it be expected that one kind of paper will prove suitable for all kinds of fruits and vegetables.

Fruit growers' associations and individual growers and packers have appealed to the bureau for instructions in specifying paper for certain kinds of wrappers and in distinguishing between paper which would probably prove satisfactory and that which would probably prove unsatisfactory. The results of careful study of the com-

position and physical properties of paper wrappers collected from manufacturers and from fruit and vegetable dealers, packers, and shippers clearly indicate that satisfactory and unsatisfactory papers for wrapping fruits and vegetables may be distinguished by physical tests. Tentative specifications sent to makers and users of the papers for criticism, when in final form, will be printed.

#### BLUEPRINT AND BROWN-PRINT PAPERS

The Government, as well as many commercial concerns, uses blue and brown-print paper in large quantities. Coated, undeveloped brown-print paper deteriorates rapidly and when not used promptly soon becomes unfit for use. In the hope of suggesting a remedy for this and of obtaining definite information on the durability of sensitized paper, an investigation was undertaken on the effect of the common commercial blue and brown-print sensitizing materials on the physical properties of the paper to which they are applied. It was found that when coated brown-print paper was kept for only two weeks before being developed and washed, its folding endurance was reduced about 75 per cent in comparison with that of the same paper uncoated. Paper coated with blueprint sensitizing materials generally used in this country, however, was kept four months without any deterioration in its strength. The results of the part of the investigation already completed were published in the April 24, 1924, issue of the Paper Trade Journal.

#### METHODS OF ANALYSIS

The results of chemical analyses of agricultural products as made by chemists in State experiment stations and colleges, in industrial work, and in the bureaus of the U. S. Department of Agriculture, are comparable only when uniform, standardized, accurate methods of analysis are used. The development of new methods of analysis or the improvement of existing methods is the constant aim of chemists working in the field of agricultural chemistry. The Bureau of Chemistry has for many years taken a leading part in this work, recognizing that progress in agricultural science can be made only as methods of chemical analysis are developed and standardized. This work is done in cooperation with the Association of Official Agricultural Chemists, and the methods developed are published from time to time by that association.

References to some of the specific methods developed during the year are made in different parts of this report under the subject headings to which they relate. Substantial progress was made during the year in this most important field of agricultural chemistry.

#### ANALYTICAL WORK FOR OTHER BUREAUS

The Bureau of Chemistry is called upon to make analyses and chemical investigations for other bureaus in the Department of Agriculture which are not equipped to do chemical work or to handle specific problems of a chemical nature which arise in their work. This analytical work covers a wide range of products. During the year analyses were made and reports prepared for the Bureaus of Plant Industry, Entomology, Biological Survey, Agricultural Economics, Public Roads, Soils, and Animal Industry, the Insecticide and Fungicide Board, the Forest Service, and other offices of the department. Practically all the chemical work on insecticides required by the Bureau of Entomology is done by this bureau.

#### SIRUP AND SUGAR INVESTIGATIONS

Cooperation with cane-sirup producers was continued, and assistance was rendered in the further extension and use of the invertase process for preventing crystallization. Advice was also given on other phases of cane-sirup production. Descriptions of the procedures for improving cane-sirup manufacture developed by this bureau have been embodied in a bulletin, which also gives up-to-date information on precautions to be observed in the manufacture of cane sirup, a description of the types of equipment employed, and the design and layout of cane-sirup plants of various types and sizes.

As a by-product of the original application of invertase to cane-sirup manufacture for the purpose of preventing crystallization, further valuable applications of invertase have been made to sorghum sirup, maple sirup, maple cream, maple sugar, and golden sirup. The use of invertase in connection with sorghum-sirup manufacture has been found of value in practice for the purpose of preventing crystallization, which occurs to a marked degree, although not so frequently as with cane sirup. In the manufacture of golden sirup, the use



of invertase permits the production of this sirup direct from an intermediate refinery sirup, thereby greatly simplifying the process and obviating the necessity of using a granulated sugar to produce the invert sugar sirup required for mixing with refiners' sirup. By using invertase, maple sirup of higher density may be made without undergoing crystallization, and the tendency to crystallize at lower temperatures is likewise diminished. Maple sugar of finer texture may be produced with less tendency to undergo "spotting." The application of invertase to the manufacture of maple cream results in a product of greatly improved consistency, with increased resistance to fermentation and from which sirup does not separate on standing, thus solving difficulties heretofore existing.

The investigation on the determination of sugar losses by inversion in various methods of manufacture of cane sugar, described in a previous report, has been almost completed. Important data have been obtained which serve to outline more definitely the conditions under which such losses may be avoided, thereby establishing the most correct conditions for operation of processes now in use.

Valuable information has been obtained as a result of the investigation of the refining value of raw sugar and the conditions which determine its suitability for the refining process. This investigation has included a study of the factors determining the friability of raw-sugar melts.

As indicated in the last report, the quantity, character, and behavior of the colloidal material present in cane and beet juices is of foremost importance in the consideration of processes for clarifying these juices in order to permit the crystallization of sugar of suitable quality and satisfactory yield therefrom. Fundamental information, scientifically determined, has every indication of being of great constructive and practical value. As a result of methods specially devised for this investigation, a quantitative separation of colloids within certain limits of degree of dispersion has been made possible, thereby permitting more accurate comparison of the efficiency of various clarification processes. Colloids thus separated from various typical sugar-factory liquors have been subjected to different types of examination, including a determination of their effect in producing viscosity. Separation of colloids from various grades of commercial sugar has been made, and the presence of this col-

loidal material has been found to have an important influence in determining the appearance of the sugar.

The improved analytical method for the determination of sucrose and raffinose in beet products, mentioned in the last report in connection with factory control of sugar recovery, was further tested in actual practice at two western beet-sugar factories during the season of 1923. The results obtained confirmed the value of the method for more accurate determination of sugar losses in the factory.

The factors which determine the recovery of sugar from cane and beets converge in two general effects—the influence on viscosity of sugar liquors and the influence on solubility of sucrose. For this reason a careful investigation is being conducted to determine the influence of various uneliminated constituents and groups of constituents of cane and beet juice upon the viscosity of factory liquors and solubility of sucrose therein. Valuable data which permit application in a practical manner toward reduction of sugar losses have been obtained.

Work on more profitable means of utilizing final or blackstrap cane molasses has been continued and, while it is not yet completed, important progress has been made.

In the course of the investigations here outlined it has been necessary to develop special methods and apparatus not heretofore available.

#### INSECTICIDE AND FUNGICIDE INVESTIGATIONS

To find combinations of chemicals which can be obtained or made cheaply and at the same time are effective in destroying or driving away the insect pests that annually destroy or cause deterioration of millions of dollars' worth of fruits, vegetables, grains, cotton, and other farm crops is one of the major projects of the Bureau of Chemistry. Some chemicals which are effective as insecticides are injurious to the foliage of the plants or trees to which they are applied. Therefore an investigation was conducted to determine why lead arsenate causes foliage injury, what effect the impurities in lead arsenate have on foliage, and what action distilled water and natural water containing various salts have on lead arsenate. The foliage-burning properties of calcium arsenate, which is used extensively to check the boll weevil, are being studied.



Progress was made in determining the composition of the salts exuded by the leaves of the cotton plant and in recognizing the great influence of these salts, when dissolved in the dew, on the action and effect of calcium arsenate and other insecticides on plants. A paper giving some of the preliminary results of this work was published in the *Journal of Agricultural Research*, volume 26, page 191, October 27, 1923. A method developed for the determination of free lime in calcium arsenate is timesaving and of great assistance in examining commercial preparations of this material. By its use the presence of basic calcium arsenates in commercial calcium arsenates has been demonstrated. Experiments in the use of colloidal arsenicals have shown that colloids such as gelatin, when added to sprays containing white arsenic, have a protective effect against leaf injury.

The results of the work to find a satisfactory substitute for carbon disulphide for grain fumigation have been very encouraging. Carbon disulphide is not satisfactory because of the high fire risk involved in its use. It is believed that a satisfactory substitute for carbon disulphide for the fumigation of insect-infested grains has been developed in the form of a mixture of 2 parts of ethyl acetate and 3 parts of carbon tetrachloride. Of more than 250 preparations tested in this work, the mixture of ethyl acetate and carbon tetrachloride is the most satisfactory. It is effective against the usual insects infesting stored grains, is noninflammable, if reasonably pure leaves no odor or taste in the fumigated grain or products made from the grain, is readily obtainable at a price that is not prohibitive, is not poisonous to man, and can be readily applied. Department Bulletin No. 1313 will give the details of this work.

Because practically all nicotine-soap preparations that have been placed on the market in the past lose their nicotine rapidly on standing, such products have practically disappeared from the market. The Bureau of Chemistry has shown how stable commercial nicotine soaps may be prepared, and the use of these effective insecticides may now be continued.

An investigation of the oxidation of white arsenic showed that the inactivity of many commercial lots when treated with nitric acid is due to the presence of traces of mercury. This information enables manufacturers of arsenic acid to improve their process

by eliminating lots that contain mercury.

The results of work on the loss of nicotine from nicotine dusts during storage, showing how nicotine dusts can be prepared and packed so as to retain their nicotine strength, will be published in Department Bulletin No. 1312.

Pure oil of larkspur seed was isolated, and its properties were determined. A preliminary entomological test indicates that this oil is poisonous to insects like the red spider. Tests of its effectiveness on other insects will be made. The effectiveness as insecticides of three alkaloids which were isolated will be tested. The object of this work is to determine whether the oil and the alkaloids are effective insect killers and to find a way to make synthetically the most active ingredient or ingredients.

In a study of pyridine derivatives for the purpose of preparing chemical compounds toxic to insects, when used as an ingredient of sprays and dusts, it was found that one of the derivatives resembles nicotine in its physical and chemical properties. As a contact insecticide on different species of aphids it acted like nicotine. Efforts are being made to perfect the reactions so as to produce the new mixtures on a commercial basis.

Progress was made on the problem of producing a synthetic insecticide similar to that contained in pyrethrum (ordinary insect powder), of which 2,973,863 pounds was imported in 1923 at a cost of \$1,397,910. The constitution of the toxic principle in pyrethrum has been solved by other investigators. The way is now open to a study of the constitution of the substance with a view to its possible synthesis and the synthesis of compounds having the insecticidal properties of pyrethrum. Compounds similar to the toxic constituents will be prepared in order to find simpler bodies containing the essential groups.

Work was done in cooperation with the Bureau of Entomology to obtain satisfactory attractants and repellents for flies which infest animals, and insecticides for flies during the various stages of their development. Experiments have been carried on, mainly with goats and cattle on the ranges, to discover a substance that can be applied to wounds that will repel flies and other insects and aid in the healing of wounds. This work has shown that small quantities of chloropicrin in mineral oil, or in pine-tar oil, are very effective in repelling

flies and that wounds treated with the mixture appear to heal rapidly. The mixture does not irritate or injure the animal in any way. The discovery of the action of this mixture gives promise of being of great value in the treatment of barbed-wire cuts and other injuries to stock on the ranges in protecting such wounds against infection, which in past years has caused the loss of thousands of dollars worth of animals annually.

A study of the absorption of hydrocyanic acid by meats, dried fruits, and confectioners' materials, fumigated with this gas, has been made and the results obtained are being published as Department Bulletin 1307, "Absorption and Retention of Hydrocyanic Acid by Fumigated Food Products, Part II."

#### PREVENTING PLANT DUST EXPLOSIONS AND FIRES

The heavy losses of life and property that sometimes result from dust explosions in threshers, grain elevators, flour mills, and starch mills, and in other industries where dusts accumulate, have been studied by specialists of this bureau with the object of ascertaining the exact causes of such explosions and of developing effective methods of prevention. Ten explosions were investigated during the year. The most recent one, an explosion in a grain elevator in Milwaukee, caused a property loss of \$600,000. Another, in a starch factory in Pekin, Ill., resulted in the death of 42 men, injury to 22 others, and a property loss of \$525,000. More than 21,000 establishments manufacturing products with an annual value of over \$6,000,000,000 in the United States are subject to dust-explosion hazards.

As previously reported, effective methods have been developed for preventing dust explosions in threshers. A few seasons ago it was not uncommon for as many as 300 threshers to be blown up in one year in Oregon and Washington, and insurance rates on threshers in some parts of the country became prohibitive. As a result of the more extended use of the methods and appliances developed by the Bureau of Chemistry, the hazard of dust explosions has been reduced to the minimum, and insurance rates have been greatly reduced on threshers equipped with the appliances made in accordance with specifications drawn up in this bureau. As a result of conferences with the Washington State Surveying and Rating

Bureau and the State fire marshal of Washington, additional recognition has been given to the dust-collecting fans designed by the Bureau of Chemistry for dust-explosion control in threshing machines. Arrangements for the manufacture of fans and fire extinguishers in Seattle afford a local service of fan production and will encourage the use of the fans and make it possible for threshermen to secure this equipment more promptly than heretofore.

During the year studies were made of dust-collecting systems and pneumatic cleaning systems in grain elevators as a means of reducing the dust-explosion hazard. The bureau obtained enough data from dust-collecting systems in Chicago, New York, Philadelphia, Baltimore, New Orleans, St. Paul, Duluth, Superior, Minneapolis, and Buffalo to be able to design dust-collecting systems of practical value for explosion control in grain elevators. This work was done in cooperation with the National Fire Protection Association, Underwriters' Laboratories, and the Terminal Elevator Grain Merchants Association. A special nozzle suitable for use in pneumatic cleaning systems was designed and patented, and arrangements have been made for installing it in the pneumatic cleaning system of a new elevator being erected in Baltimore.

Special studies relating to the type and operation of industrial drying machinery and similar devices used in handling dusty products were conducted. Conferences pertaining to control measures for the prevention of dust fires and explosions in grain-handling plants were held with industrial operating companies and machinery manufacturers. Explosions following dust fires in such plants have caused great loss of property, and special efforts are being made to assist the manufacturers of drier equipment in the control of this hazard. This work is being conducted in cooperation with a number of industrial companies, manufacturers of mechanical equipment, and State safety commissions.

Investigations relating to the application of inert gas for the prevention of explosions in grinding machinery have shown that the reduction of the oxygen content of the atmosphere will prevent flame propagation in explosive dust clouds. As a result of this work, successful operating units have been installed at two large hard-rubber plants. The installation of a similar



unit, for use in grinding oat hulls, is the first adaptation of inert gas to the grain industry. The successful application of inert gas in grain handling will be of great value in reducing losses from dust explosions and fires.

Progress was made in the laboratory investigations in determining the effect of lowered oxygen content of air on the explosibility of dust in suspension, and a preliminary report was published. The experimental work on the effect of humidity on the explosibility of flammable dusts in the air was completed, and a report was prepared for publication. The positive, if not striking, results obtained should eliminate uncertainty as to the effect of gaseous water vapor on the explosibility of dust. The experimental work on the effect of humidity on the dissipation of static electricity indicates that about 40 per cent relative humidity at 25° C. is approximately the minimum humidification required to prevent the accumulation of static electrical charges. Plans were made to study the effect of prolonged heating on several type dusts. Investigations in the field indicate that a number of explosions have been caused by the ignition of dust much below the usual ignition temperatures, and in these cases it is thought probable that ignition resulted from prolonged contact with a source of heat. Service testing was done through the year to determine the explosibility of representative industrial dusts submitted by manufacturing companies, State industrial commissions, and insurance associations.

In cooperation with the dust explosion hazards committee of the National Fire Protection Association and the industries concerned, regulations were prepared for the prevention of dust explosions in the following industrial plants: Sugar-pulverizing systems, pulverized-fuel plants, grain elevators, flour and feed mills, cocoa-grinding installations.

Progress was made in negotiating for further reductions in insurance rates on cotton gins which use the methods and appliances developed in the Bureau of Chemistry for preventing fires.

#### IMPROVING ROSIN AND TURPENTINE PROCESSES

As a rule rosin and turpentine are produced in small plants scattered throughout the pine-growing sections of the South. Because of inefficient methods in many of the plants the yield is low and the rosin and turpen-

tine are too often below a fair standard of quality. The Bureau of Chemistry has made a scientific study of rosin and turpentine production, with the result that improved methods of production have been developed.

During the last year work on demonstrating methods for making more and better turpentine and rosin and for reducing costs of operation was pushed actively. Turpentine stills were visited and conferences on methods of operation were held with producers. As a result the industry has been awakened to the need for improvements in production.

Demonstrations were held at many plants, at which there was a good attendance of visiting operators and stillers from nearly all the stills within easy traveling distance. At one place 35 visiting naval-stores men, representing 29 producing firms, were present. The usual procedure was for the regular stiller to run a charge according to his practice, under the observation of the demonstrator and the visiting operators. Careful note was made of the character of the crude gum stilled and the yield and quality of the products. This was followed by a similar charge run by the demonstrator or by the stiller under the demonstrator's immediate direction. Improvements in procedure were called to the attention of the operators and stillers, and the reasons and results were explained. The plant and equipment were then carefully inspected, both good and bad features being pointed out, and recommendations for improvements were made. Those in attendance were supplied with blueprints showing the construction and operation of various kinds of equipment which could be readily made by the operators, and which would yield more and better products and save avoidable losses.

Six special circulars on various phases of naval-stores production were prepared and distributed to all naval-stores producers.

Much attention was given to the study of methods for detecting steam-distilled wood turpentine in gum spirits. The existing methods are not entirely satisfactory, and work on this problem will continue. Work was also done on the analysis of rosin, particularly on the determinations of the "iodine number" and melting point. In manufacturing "gloss oil," a low-cost and extensively used varnish, consisting primarily of rosin or limed rosin dissolved in naphtha or kerosene, there is a material clouding and



settling out from some batches. This behavior, which is characteristic of some rosins, greatly decreases the value of the gloss oil and causes heavy losses in its manufacture. A method to predetermine the behavior of any lot of rosin in this respect has been worked out, as has also a procedure whereby the clouding and settling out can be prevented.

The standards of quality for the various grades of rosin as represented by the permanent glass types have been made the official rosin standards of the United States. The naval stores act requires that all rosin sold within its jurisdiction must be graded in accordance with these standards.

A statistical report showing stocks of turpentine and rosin held by dealers at the main ports and distributing centers of the country, as of March 31, 1923, was published. Statistics on the stocks of turpentine and rosin held at manufacturing plants by the principal consuming industries, as of the same date, together with the figures showing consumption during the year 1922 by the same industries and stocks at ports and distributing points, were published in a joint report by the Bureau of Chemistry and the Bureau of the Census.

Statistics have been collected on the consumption of turpentine and rosin by industries during the year 1923, together with data on the stocks held by consuming industries and at ports and distributing points, as of March 31, 1924, which is the close of the fiscal year in the naval-stores trade.

#### COLOR INVESTIGATIONS

Basic research work to aid in the development of the dye industry in the United States was continued during the year. Previous reports have told of the development of improved methods of the manufacture of various dyes and of intermediates used in the manufacture of dyes. Highly satisfactory dyes and intermediates are now being manufactured commercially by methods developed in this bureau. The fact that in 1923 there were produced in the United States over 93,500,000 pounds of coal-tar dyes, with a value of about \$50,000,000, as compared with the production of only 6,620,000 pounds, valued at about \$2,500,000, in 1914, indicates the growth of this industry in the United States. Furthermore, most of the dyes manufactured in the United States in 1914 were made from intermediates imported from Germany. The production of intermediates in the United States in

1923 was about 230,000,000 pounds. The United States now produces about 96 per cent of the dyes consumed here.

During the last year, special attention was given to the analysis of biological stains for the purpose of establishing specifications for their certification. These dyes are used by bacteriologists, health officers, and physicians for identifying microorganisms that produce disease. Formerly these stains could be obtained only from Germany. While biological stains are not of great importance commercially, they are of the very greatest importance from the point of view of public health, and the war showed that it is essential for this country to be independent of any foreign supply. The work has resulted in the drawing up of specifications for the certification of hematoxylin, safranin, basic fuchsin, and acid fuchsin, in addition to methylene blue, which was reported last year. Work is now under way for the certification of eosin, gentian violet, pyronin, and orange G. This work has shown that some of the American stains are as good as, or better than, the pre-war imported stains, and has led to more exhaustive researches on the question of staining.

A water-soluble tar, very difficult to remove, is always formed in the preparation of sulphonic acids. A simple, inexpensive method of rendering this tar insoluble, devised in the bureau, promises to be of general application.

Work started on the production of beta-aminoanthraquinone, needed as an intermediate for vat dyes, has resulted in the determination of suitable conditions for its production. Another new intermediate, methylisopropylantraquinone, has been prepared from para-cymene obtained as a by-product from the bisulphite process of manufacturing paper pulp. Heretofore, para-cymene has been largely a waste by-product.

A method of determining the dissociation constants and hydrogen-ion concentration of indicators by use of the spectrophotometer has been devised and successfully applied to two of the new indicators. The spectrophotometer has also been successfully applied to the determination of the identity of closely related dyestuffs which formerly defied chemical differentiation.

One of the most pressing needs of the day is the accurate determination of physical constants, such as freezing and boiling points and vapor-

pressure curves. The Color Laboratory, therefore, has undertaken the determination of these constants for a large number of compounds. The determinations on four of these have been completed and will be published shortly.

The examination of commercial food colors to see that they were free from harmful impurities was continued. During the year, 232,305 pounds of straight dyes, 26,956 pounds of repacks of straight dyes, and 286,148 pounds of mixtures were certified by manufacturers. Food colors were certified by 30 firms, six of which had never certified colors before. Nine batches of straight dyes and one batch of mixture were rejected.

### CHEMICAL WORK FOR OTHER DEPARTMENTS

The Bureau of Chemistry is called upon by the various departments of the Government for a great volume and variety of chemical work, ranging from making a chemical analysis of a food product for the Army or Navy, to see that it complies with the specifications under which purchased and that it is otherwise suitable for food, to giving expert advice on an involved technical chemical problem. The specialists of this bureau are being called upon daily for information and advice on chemical problems by many branches of the Government service.

The requests for chemical analyses by other departments have grown to such proportions that this work threatens to encroach seriously on the regular duties of the bureau. The advantage of having this work done in a thoroughly equipped central bureau, manned with specialists, rather than in a number of small laboratories in widely scattered departments, is obvious. The work can be done more efficiently and at a smaller cost because of the higher degree of specialization possible where a comparatively large staff of chemists is employed and because of the volume of data already available on many of the questions that arise. How far this work should be permitted to retard the regular work of the bureau for which specific appropriations are made, however, is a grave question. It may be necessary for the Bureau of Chemistry to limit the work it does for other departments or to effect a plan whereby some compensation may accrue from it.

At the request of the Post Office Department, this bureau investigates the composition and medicinal proper-

ties of many so-called remedies and cures which are advertised and sold through the mails, in order to assist that department in determining whether they should be classed as fraudulent under the postal laws. Analyses of the products are made when necessary, and expert testimony is furnished at hearings and at court trials. Some of the misbranded medicinal preparations sold direct to consumers can be reached more effectively under the postal laws than under the Federal food and drugs act. Fraud orders have been issued denying the use of the mails to a number of concerns putting out worthless preparations for which false and fraudulent claims were made by the proprietors.

Examinations were made of 301 samples of blueprint and brown-print papers and cloths from the Navy Department and 58 miscellaneous samples of paper from other departments. Forty-nine samples of bookbinding leather and 17 samples of rosin-oil varnish were examined for the Government Printing Office. Assistance was given to the Federal Specifications Board in furnishing data on and preparing specifications for paper, paint, lime, and leather. Assistance on paper specifications was also given to the Congressional Joint Committee on Printing. Several hundred samples of food were examined for the War Department, the Navy Department, the Marine Corps, General Supply Committee, United States Shipping Board, Panama Canal Commission, Internal Revenue, Bureau of Indian Affairs, Federal Trade Commission, Department of Justice, Customs Division, and Walter Reed Hospital. Samples of drugs were also examined for other departments. The laboratories of the bureau in 16 of the larger cities throughout the United States have made chemical analyses for other departments.

### ENFORCEMENT OF THE NAVAL STORES ACT

No appropriation for the enforcement of the naval stores act, approved March 3, 1923, was available for the fiscal year ended June 30, 1924, but regulations authorized by the act were prepared, and plans were formulated for the actual work of enforcement.

The naval stores act provides that the Secretary of Agriculture "shall examine, if practicable, upon request of any interested person, any naval stores and shall analyze, classify,



or grade the same on tender of the cost thereof as required by him, under such regulations as he may prescribe. He shall furnish a certificate showing the analysis, classification, or grade of such naval stores, which certificate shall be prima facie evidence of the analysis, classification, or grade of such naval stores and of the contents of any package from which the same may have been taken, as well as of the correctness of such analysis, classification, or grade and shall be admissible as such in any court."

The Secretary of Agriculture is authorized to purchase from time to time samples of spirits of turpentine and of anything offered for sale as such, for the purpose of analysis, classification, or grading, and of detecting any violation of the act. Naval stores offered for import or export, as well as naval stores that enter interstate commerce, are subject to all the provisions of the act.

Regulations for the enforcement of the act have been issued covering, among other things, samples and directions for taking samples, form of request for and cost of analysis, classification and grading, issuance of United States certificates, labeling United States examined turpentine and rosin, loan and care of duplicates of United States standards, and publications and hearings.

An appropriation of \$10,000 for the enforcement of the act became available on July 1, 1924. The necessary equipment for the sampling, grading, classification, analysis, and marking of naval stores has been secured, and the necessary forms for the work devised and printed. A force of three men has been organized, and provision has been made for the active enforcement of the act to the extent which the funds available will permit.

### TEA INSPECTION ACT

All tea imported into the United States is examined at ports of entry for quality and purity, as determined by comparison with United States standards for tea established under authority of the tea inspection act. During the last fiscal year 104,492,743 pounds of tea was examined at all of the ports of entry. Of this, 63,159 pounds, or 0.06 per cent. was rejected. All of the rejections were for quality. No coloring or facing material was found in any teas during the year.

This indicates a marked improvement, since at one time most of the rejections were caused by teas not being up to the Government standard in purity because of coloring and facing.

Table 1 shows the quantity of each variety of tea imported, passed, and rejected and the quantity of tea examined at each port of entry.

TABLE 1.—*Kinds and quantities of tea passed and rejected during the fiscal year ended June 30, 1924*

Variety or port of entry	Examined	Passed	Re- jected for qual- ity
	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
Formosa Oolong	12,515,606	12,501,802	13,804
Foochow Oolong	18,467	18,467	-----
Congou	8,579,588	8,557,412	22,176
India	15,054,374	15,052,819	1,555
Ceylon	23,790,430	23,790,347	83
Blended Ceylon and India	458,205	458,205	-----
Java	8,030,578	8,018,737	11,841
Sumatra	1,909,013	1,909,013	-----
Ceylon Green	1,304,334	1,304,334	-----
Ping Suey Green	6,975,044	6,975,044	-----
Country Green	2,246,681	2,246,661	20
Japan	21,232,269	21,231,541	728
Japan dust	1,360,430	1,360,430	-----
Capers	7,800	7,800	-----
Scented Orange Pekoe	47,473	47,473	-----
Scented Canton	580,017	579,917	100
Canton Oolong	294,165	281,313	12,852
Tabloid	660	660	-----
India Green	80,443	80,443	-----
African tea	7,166	7,166	-----
Total	104,492,743	104,429,584	63,159
Boston	20,136,148	20,121,494	14,654
Chicago	3,849,159	3,849,099	60
Honolulu	358,075	358,075	-----
New York	54,365,243	54,336,880	28,363
Puget Sound	11,978,189	11,977,889	300
St. Paul	986,800	986,800	-----
San Francisco	12,819,129	12,799,347	19,782
Total	104,492,743	104,429,584	63,159

### ENFORCEMENT OF THE FEDERAL FOOD AND DRUGS ACT

The volume and the variety of foods and drugs that are shipped into interstate and foreign commerce increase steadily from year to year. The value of all foods manufactured annually is 4 times greater than the value of all men's and women's clothing manufactured each year; it is 6 times greater than the value of the yearly production of automobiles; it is 10 times greater than the value of all boots and shoes manufactured annually; and it is more than 4 times the



value of the output of all iron and steel mills. These comparisons are based on the value of manufactured foods and do not take into consideration the enormous traffic in unmanufactured foods, such as eggs, milk, nuts, fruits, vegetables, grains, and the like, to which the Federal food and drugs act applies when they are shipped within its jurisdiction. Important as the food industry is from an economic point of view, it is even more important when considered from the point of view of the public health and of the general well-being of the people everywhere.

To maintain an effective supervision over the production, manufacture, transportation, and sale of the food, medicine, and drink that are consumed by 110,000,000 people is a stupendous task, requiring the solution of many intricate problems to determine what constitutes adulteration and misbranding in food and drugs and to demonstrate how products of a fair standard of purity can be manufactured or produced under widely varying conditions. The Federal food and drugs act was enacted at a time when gross adulterations and misbrandings were prevalent in the foods and drugs that entered interstate and foreign commerce. It supplemented State and city legislation. The marked improvement in the quality and purity of foods and drugs that has been brought about in recent years is the result of the united efforts of Federal, State, and city food, drug, and health officials working in close cooperation on common problems, and of the assistance of various leaders in the food and drug industries who have had the vision to see that the elimination of objectionable practices would be of benefit to the industries as well as to the consumers.

Under a project system of planning work to which reference has been made in previous reports, attention is systematically directed toward the staple foods which constitute the bulk of the diet and toward such other products as are most commonly sophisticated.

Twelve thousand seizures and prosecutions based on the adulteration or misbranding of foods and medicines under the Federal food and drugs act have been completed, and the results of each published, since the enactment of the law. The twelve thousandth notice of judgment was issued during the year.

#### FORMS OF ADULTERATION AND MISBRANDING ENCOUNTERED

New forms of adulteration and misbranding are found from time to time, and the work during a year covers a great variety of products and many forms of sophistication, although in accordance with the project system attention is centered on staple products. Specific reference can be made in this report to only a few of the products which received special attention during the year.

**Canned salmon.**—The practice of canning decomposed salmon in certain canneries was mentioned in the last report. The necessity for continued and intensive regulatory activity forecast at that time has been fully justified by developments during the past fiscal year. Seizures of 62 shipments of the product were made, and 49 criminal prosecutions were inaugurated. No improvement in conditions prevailing during preceding seasons was apparent. Six seizure cases were vigorously contested by the packers during the year. Decomposed fish, varying from 10 to 50 per cent, was found in the shipments. The packers contended that it was impracticable to eliminate all rotten fish from their product and made the point that no harmful effects have resulted from the consumption of rotten salmon. The Government introduced testimony to the effect that it was practicable to eliminate rotten fish from the pack. The question of whether canned rotten fish is harmful to health was not an issue, since the law defines decomposed products as adulterated, regardless of whether they may or may not be harmful to health. Juries before whom these seizures were tried upheld without exception the contention of the Government that these shipments violated the law. It is to be hoped that the uniform success in winning these court cases may have the effect of curbing the illegal practices of those canners who have not kept pace with the better elements of the industry in adopting precautionary measures to prevent the canning of decomposed fish. Recent inspections, however, have shown a continuation of objectionable practices on the part of certain canners which will necessitate continued and intensive regulatory activity.

**Butter.**—During the year special attention was given to interstate shipments of butter to determine whether or not it complied with the recently enacted legal standard which provides

that butter shall contain not less than 80 per cent by weight of milk fat, all tolerances having been allowed for. Examinations of many shipments showed that some butter being shipped into interstate commerce did not contain 80 per cent fat. During the year 194 prosecutions were instituted and 102 seizures effected. This has resulted in a decided improvement in the butterfat content of the butter shipped into interstate commerce.

**Jams, jellies, and preserves.**—Fifty-eight court actions, including 22 prosecutions and 36 seizures, were instituted during the year because of the adulteration or misbranding of jams, jellies, preserves, and similar products. The most common form of adulteration in these products is the substitution of pectin for a part of the fruit. A decision outlining a method for labeling correctly certain compound and imitation jams and preserves was issued.

**Nuts.**—The shipment interstate within the jurisdiction of the Federal food and drugs act of wormy and moldy nuts resulted in 6 prosecutions and 34 seizures. Several consignments of various nuts offered for entry into the United States from foreign countries were excluded because they were found to contain worms and mold.

**Edible oils.**—Every year it is necessary to take legal action because of the adulteration or misbranding of vegetable oils. A common form of adulteration is the substitution in whole or in part of cottonseed oil for olive oil. Cottonseed oil is an excellent table oil, but its sale as olive oil at a higher price than it would command under its own name is a fraud. Violations of the law involving edible oils were responsible for 27 court actions during the year.

**Stock feeds.**—One hundred and eleven prosecutions and 120 seizures were brought on charges involving the adulteration or misbranding of stock feeds. The most common form of violation in these products is the overstatement on the labels of the protein content of the various feeds. As the price of feeds is usually determined by the protein content, there is a continual temptation for dealers to overstate the percentage of protein and thus obtain a higher price for the feed.

**Canned fruits and vegetables.**—Sixty-one court actions involved canned fruits and canned vegetables. A common violation of the law where these products are concerned is the use of too

much brine or sirup and too little vegetable or fruit. The Bureau of Chemistry holds that a can should be as full of solid food as is practicable and has devoted much attention to securing a proper fill of can.

**Oats.**—A special campaign to break up the practice of adulterating oats was conducted in the Middle West. The chief adulterants were added screenings and excess water. Several carloads from various shippers were seized. An improvement in the prevailing practices has undoubtedly resulted.

**Flavoring sirups and concentrates.**—The traffic in flavoring sirups, flavoring concentrates, and other flavoring preparations is extensive. It is estimated that the total annual production of fountain sirups is about 60,000,000 gallons, most of which enters interstate commerce. Much attention was directed toward adulterated and misbranded sirups alleged to contain grape juice, but which consist of sugar, fruit acid, imitation grape color, and imitation grape flavor. Attention has been given also to orange sirups and other orange preparations alleged to contain orange juice, but which are flavored merely with oil of orange and are made turbid or cloudy by the use of gum. Sirups which contain some fruit juice, but not enough to characterize them as genuine fruit sirups, also fell into this class of products. Improvement has been made in the labeling of these preparations.

**Eggs.**—One hundred and three court actions were brought on adulterated eggs. Included in this number are cases involving frozen eggs, which are used extensively by commercial bakeries, hotels, and restaurants in baking and cooking. Most of the cases, however, were based upon the shipment into interstate commerce of consignments of shell eggs, a part of which were rotten. Interstate shippers of eggs have been warned frequently to candle them in order that the rotten eggs might be eliminated, but although there has been a very great improvement in the quality of eggs shipped into interstate commerce, it is still necessary to seize shipments containing rotten eggs.

#### PROSECUTIONS AND SEIZURES

The court actions instituted during the year summarized in Table 2 indicate the scope and variety of the products involved.



TABLE 2.—*Summary of prosecutions and seizures*

Product	Prosecutions	Seizures
Alimentary pastes.....	3	3
Baked products.....	24	3
Beverages.....	6	30
Butter.....	194	102
Cheese.....	1	10
Coffee.....	11	3
Colors.....	4	1
Confectionery.....	20	7
Drugs (crude).....	1	2
Eggs:		
Frozen.....	1	19
Liquid.....		1
Shell.....	52	30
Substitutes.....		1
Feeds.....	111	120
Fish:		
Canned.....	49	100
Shell.....	36	20
Flour.....	5	33
Food flavors.....	6	9
Fruit:		
Canned.....	1	21
Dried.....	7	4
Fresh.....	4	8
Frozen.....		2
Juice.....		2
Ice cream.....	3	
Jellies, jams, preserves.....	22	36
Meal (corn).....	3	4
Milk (condensed).....	1	2
Molasses.....	4	2
Mustard.....		5
Nuts.....	6	34
Oils.....	16	11
Olives.....		4
Pickles.....	1	1
Pie filling.....	3	1
Remedies.....	47	117
Sirup (table).....	11	6
Spices and condiments.....	2	4
Tea.....	3	1
Vegetables:		
Canned.....	2	37
Fresh.....	12	4
Vinegar.....	18	1
Water.....		7
Total.....	690	808

#### DRUG CONTROL INVESTIGATIONS

The Drug Control Laboratory and the field forces of the Bureau of Chemistry work in very close cooperation in enforcing the provisions of the food and drugs act which relate to drugs.

Activities in connection with drugs have been concentrated principally on the following subjects: (1) Medicinal tablets containing important therapeutic agents; (2) galenicals; (3) crude drugs, including herbs, leaves, barks, roots, flowers, seeds, etc.; (4) medicines offered for the treatment or prevention of serious diseases; (5) nitrous oxide manufactured and sold in the United States; (6) methods of analysis for certain important drugs.

**Medicinal tablets.**—During the year analyses have been made of approximately 700 samples of the more important medicinal tablets manufac-

tured and sold in the United States, including tablets of strychnine sulphate, quinine sulphate, nitroglycerin, morphine sulphate, heroin hydrochloride, codeine sulphate, atropine sulphate, aspirin, and acetphenetidin, which are labeled to show their purported content of active ingredients. Unusual care has been given to the analyses of these preparations. Where appreciable variations from declared standards have been found, check analyses by a second and sometimes by a third analyst have been made. This investigation has shown that while most of the products comply reasonably well with their declared standards, many need improvement. In some instances the variations were so great that prosecutions are being instituted against manufacturers. The number of manufacturers of these products, the wide variety of medicines prepared in tablet form, and the existing conditions made it impossible to complete an investigation adequate to remedy the conditions during the year. This work will be actively prosecuted during the next fiscal year. The pharmaceutical manufacturing industry has taken an active interest in effecting improvement in this class of preparations and has appointed a committee to cooperate with the Bureau of Chemistry with a view to extending investigations, pooling information, and taking such other steps as may be necessary for improving the quality of medicinal products, especially tablets. It is hoped that this gratifying action on the part of the industry will result in an improvement which will obviate in large measure the necessity for using strictly regulatory measures.

**U. S. Pharmacopœial, National Formulary, and other galenicals.**—An exhaustive survey of some official and unofficial galenicals on the American market was made, primarily to obtain information on which to base a comprehensive regulatory project in the event that the results obtained indicated the necessity for it. The products examined include tincture of belladonna leaves, fluid extract of belladonna leaves, tincture of belladonna root, fluid extract of belladonna root, fluid extract of colchicum seed, tincture of colchicum seed, fluid extract of colchicum corm, powdered extract of colchicum corm, wine of colchicum corm, wine of colchicum seed, colchicine, fluid extract of nux vomica, tincture of nux vomica, powdered extract of nux vomica, fluid extract of ipecac, tincture of aconite, tincture of digitalis, etc. The products investigated are highly important



drugs, used principally in filling physicians' prescriptions. Many of the samples examined varied materially from the official or declared standards of strength, showing the necessity for an exhaustive investigation.

**Crude drugs.**—The study of methods and the effect of atmospheric humidity, temperature, drying agents, etc., on moisture determinations in crude drugs was continued. An apparatus for melting-point determinations of minute quantities of substances was devised. Further experimental work on the direct sublimation of crystalline substances from plant and animal products was conducted. Methods for the detection of hydrocyanic acid in plants were studied. Regulatory questions arising in connection with the importation of *Cactus grandiflorus*, N. F., and the disposition of adulterated or substituted Wahoo bark (*Euonymus atropurpureus*) necessitated investigations of these products to determine their sources, means of identification, and chemical and anatomical characteristics.

**Patent or proprietary medicines.**—Previous activities of the Bureau of Chemistry in connection with proprietary medicines have been continued. While there has been a great improvement in the labeling of this class of preparations, as a result of the consistent support of the department's interpretation of the law by the United States courts and attorneys and the prompt action of Congress in remedying the only serious defect which the courts have found in the food and drugs act, much is yet to be desired. During the past year special attention has been given to misbranded medicines sold in large volume for the treatment of serious diseases, such as diseases of the kidney. As a result of this activity improvement in the labeling of this class of products has been made. The work during the next year will be continued along the same general lines.

**Nitrous oxide.**—Owing to its importance and increasing use as an anæsthetic in dental surgery, general surgery, and obstetrics, a comprehensive survey of the nitrous oxide manufactured in the United States was undertaken. Practically every factory producing this article was inspected and samples in the channels of commerce from each of such factories were analyzed. While the manufacturing methods of some of the producers are not above criticism, on the whole the conditions seem comparatively satis-

factory. None of the samples examined contained more than a trace of nitric oxide, the poisonous contaminant most likely to occur in this preparation. Careful control should be maintained over this important anæsthetic by municipal, State, and Federal regulatory officials in guaranteeing to patients the use of a pure and safe product.

**Methods of analysis.**—As adequate control of drug products is dependent on reliable methods of chemical analysis, a critical study of existing methods, with a view to improving or simplifying them, is necessary, and methods for drugs for which no methods or inadequate methods only are available must be devised. During the past year a critical study has been made of the methods of analysis of preparations of nux vomica and ipecac. The methods devised will probably be applicable to other drugs containing alkaloids. In collaboration with the Color Laboratory, a report on the detection and identification of small quantities of phenols has been published. The methods employed give promise of having wide application in the detection and identification of phenols, many of which occur in drug products. The study of methods of analysis of phenolphthalein, an important laxative drug, has been continued, as a result of which the method of analysis previously devised has been simplified and applied to more complex mixtures than heretofore. Several new pieces of apparatus have been devised for the purpose of either increasing the accuracy of chemical analysis or decreasing the time of the analyst in making analyses.

#### FOOD CONTROL INVESTIGATIONS

As the result of a study on the composition of alimentary pastes and the raw material used in their manufacture, the analysis of noodles of known composition was reported in the Journal of the Association of Official Agricultural Chemists. The data compiled have been valuable in estimating the egg solids content of noodles.

Baking tests were made on prepared waffle flours with egg contents varying from 0 to 5 per cent. The waffles containing the most egg were considered best. A similar investigation on pancake flours did not show a correlation between egg content and the quality of the pancakes. An investigation of the value of sweet-potato flour as a bread improver was made.

The bakings did not indicate in any way that the addition of small quantities of sweet-potato flour in the formula improved definitely any quality of the loaf, but rather that frequently somewhat inferior loaves were produced.

It was shown that cocoa can be used to advantage in the baking formulas of rolls and bread.

Moisture determinations of various grades of flour indicated that flour with a moisture content within the limits of the standard is being produced throughout the country. Further work will be necessary to obtain definite information regarding the moisture content of the output of mills in different sections of the country and at different times of the year. A thorough study of the methods for determining moisture in flours was made, and a rapid method for determining the ash in flour, which gives results in half the time required by the regular official method, was developed.

Work was done on the improvement of methods for analyzing dairy products.

An investigation of mixtures of fruit, sugar, and commercial pectin, using fruit of known composition, was conducted for the purpose of collecting data for use in actions under the law against preserves and other fruit products adulterated with pectin.

Much work was done in the development of both organoleptic and chemical tests to detect spoilage in canned salmon, the results being used in the presentation of evidence in court cases. Work was also done on sardines in connection with the problem of "feedy" fish.

Commercial processes of packing Lima beans, peas, pitted cherries, and corn were investigated. A laboratory study of the proper fill of blanched and unblanched string beans was made. Work was done on the proper fill-of-can and the chemical composition of canned grapefruit.

#### MICROBIOLOGICAL INVESTIGATIONS

The food products involved in the outbreak of botulism at Sterling, Colo., were examined, and *Bacillus botulinus*, Type A, was isolated from the home-canned string beans responsible for the outbreak. The organism was also found in sausage actually consumed by those suffering from the poisoning, but the sausage itself when fed to experimental animals proved nontoxic. On the other hand, the string beans when

fed were poisonous. This outbreak was followed by the poisoning of a group of people at Coalinga, Calif., from commercial canned ripe olives. Two olives from the container responsible for the poisoning were strongly toxic when fed to experimental animals. An investigation of a whole series of cans from the same lot disclosed the presence of no more poisonous olives. The condition of the olives and the presence of various species of bacteria in viable condition in the containers, however, point to careless methods in the factory.

In connection with the study of soundness in canned food, it has become increasingly evident that the problem of preservation is closely bound up with the bacteriology of the raw materials entering the cannery. Vegetable products are always contaminated with microorganisms from the soil or other sources. Ordinarily entirely fresh products carry these organisms only as spores or as inactive bacteria. In the gathering, handling, and transportation of vegetables to the market or to the factory many opportunities for active bacterial growth occur. Students of the canning industry have shown that the difficulties in producing sterility in the can are closely correlated with the bacteriological conditions in the raw materials.

A study of the bacteriology of a series of vegetables, product by product, offers a clue to the precautions necessary to insure soundness in these food products, whether for manufacturing purposes or for direct consumption. Such a study of spinach was previously reported. During the past year studies of corn and asparagus have been conducted upon the same lines.

In the corn-canning regions of Illinois and Iowa the fresh sweet corn was followed from the field through to the finished pack. Even in the field the ear of corn is contaminated with small numbers of microorganisms inside the husk and in contact with the grains of corn. The course of multiplication of this initial contamination was followed through the steps of handling. Masses of sweet corn pulled from the stalk and in transit to the factory or in the storeroom of the factory before husking heat very quickly and become wet and subject to tremendous multiplication of microorganisms, so that the initial contamination reaches fabulous numbers if the product stands overnight or over Sunday. The heat in such piles quickly rises



above blood heat, occasionally almost to the temperature of pasteurization. The difficulties of producing a sound product from corn in such condition are tremendously increased. Many of these organisms are heat-resistant spore-formers, which not only multiply vegetatively but produce great numbers of spores, even in a comparatively few hours of heating. It is thus clearly indicated that there is substantial reason for great haste in handling corn for canning.

A continuation of the bacteriological studies in oyster spoilage has made possible a report covering the types of organisms found and a special consideration of the types of bacteria responsible for the significant phases of spoilage in this product.

Extensive abuses in the canning of sardines necessitated the bacteriological examination of many cans. Objectionable practices in sardine canning were evidenced, first, by spoilage in the can as indicated by swelled cans found in such quantities in the output of a single factory as to necessitate the seizure of almost the entire season's pack of that concern, and, second, by the packing of rotten or partially rotten fish. This represented a resumption of objectionable practices which had largely disappeared for a time as a result of the campaign conducted by the bureau in 1915 and 1916. A survey of the problems involved showed the necessity for further work during the current fiscal year to correct the sardine situation in Maine.

Reference has been made on page 3 to the extensive losses in handling forage and feeding stuffs and, to some extent, human foods which occur as a result of biological heating processes. Sometimes these heating processes, if occurring under the most favorable conditions, bring about the spontaneous combustion of large masses of the product, together with such other property as may be in contact with the burning materials. During the last quarter of this year a systematic series of experiments was begun to produce these heating processes under known and controlled conditions. For this purpose special apparatus was devised—insulated chambers, into which known quantities of oxygen could be introduced at any desired rate. Under these conditions it has been possible readily to produce temperatures of 60° C. or slightly higher. Experiments to determine the agents responsible for this heating process and to define as

closely as possible the conditions under which such heating may be anticipated are in progress.

Cultural studies of *Penicillium* and *Aspergillus* and species of related genera were continued. Cultures have been maintained for the past 10 years. This series of organisms in culture now contains nearly 1,000 strains to which contributions are constantly being made. All studies of material are being brought together into a monographic key to these two great genera of saprophytic molds.

The experience obtained in the cultural examination of these collections, together with the possession of authentic cultures representing the species described in the literature, makes it possible to assist in the solution of many problems. The correspondence during the past year has included mold problems involving human pathology, the decomposition of sugar and sugar products, the molding of tobacco, the deterioration of rubber, the activity of molds in the fermentation industries, and the significance of species and groups of species in the soil, as well as the taxonomic study of the fungi themselves.

#### MICROCHEMICAL INVESTIGATIONS

A study was made of cacao products with special reference to the shell content. Preliminary studies were made on methods of quantitative estimation of wheat and rye middlings when mixed, of barley in ground mixed-feed barley, of hoof meal in digester tannage, and of flax-plant waste in alfalfa. Work was continued on the source of products and by-products used in feeds.

A survey was made of the character of the strawberry, raspberry, and blackberry products on the market. As a result of studies on the methods of packing blueberries and cherries, suggestions for improvements in packing methods and in the quality of the products have been made to canners. Microscopic examinations were made of a variety of products as a basis for court actions, especially with respect to adulteration in nuts, tomato products, stock feeds, and fruits.

A paper on the "Microscopical identification of some sodium and potassium salts" has been published, and one on "The determination of the optical properties of the amino acids" is in press. Work is being continued on photographic tests on radioactive and pseudo-radioactive substances and on the pollen content of honeys.



### PHARMACOLOGICAL INVESTIGATIONS

Certain drugs for which chemical assay methods are not feasible are tested biologically. Among these drugs are digitalis and strophanthus, which are vitally needed in some types of heart disease; ergot and pituitary preparations, which are frequently used in obstetrics; and insulin, which is used in the treatment of diabetes. Bioassay methods for aconite, cannabis, digitalis, strophanthus, squill, epinephrine, ergot, and pituitary preparations will be included in the forthcoming tenth revision of the United States Pharmacopœia. The physiological effects produced by a commercial preparation are to be compared with the effects produced by a standard sample. Great variations have been found in the strength of the commercial preparations of these drugs now appearing upon the market, the products of some manufacturers being more than ten times as active as corresponding preparations made by other manufacturers. Believing that the use of common standards would directly assist in reducing such variations and in improving the character of marketed preparations, the bureau has arranged to furnish prototype standards upon request. The use of such standards is expected definitely to reduce the variation of commercial preparations of these potent drugs. Attention is also being directed to the physiological effects produced by various pancreatic preparations recommended for use in the treatment of diabetes.

Work was continued on the pharmacology of arsenic, tin, and other heavy metals. Information on the toxicity of various food preservatives was collected. A study of the comparative toxicity of aliphatic alcohols and alkyl esters was made, and, in collaboration with the Bureau of Biological Survey, the efficiency of dried squill preparations as rat poisons was investigated.

### STOCK FEED CONTROL

Work to determine standards and definitions for various cattle feeds sold on the American market has been continued. This includes the study of products and methods of preparation, as well as the proper way to state definitions and the desirability and correctness of standards. A paper on barley and its by-products and one on the milling of buckwheat have been prepared. Work on a method for the determination of leaves and stems in

alfalfa meal is in progress. The results of the work on oat by-products and corn by-products will soon be published.

### CONTROL OF WATER AND BEVERAGES

Control of the purity of mineral water shipped in interstate commerce is now maintained largely by inspection at the springs or wells. Work of this type is essentially educational. The shippers of the water are shown that near-by toilets, broken curbing, rusted-out casings, cold-water rinsing of bottles, dusty corks, and the like may result in contamination dangerous to health. It is very difficult sometimes to convince a bottler that his procedure is at fault and still more difficult to persuade him to change long-established habits. Three large mineral-water resorts in the United States now maintain constant analytical control of the purity of the mineral waters shipped in interstate commerce.

Surveys of commercial water supplies were made in Kentucky, Tennessee, Mississippi, Texas, Arkansas, and Missouri. Ninety-four wells and springs were inspected, and suggestions for improving the purity of the waters shipped into interstate commerce were made.

Numerous court actions were developed against imitation grape soda-water flavors made with grape wine and oil of cognac, with a little added methyl anthranilate. None of the court actions involving this point so far brought to trial have been contested. The manufacturers are generally labeling such products as imitations in compliance with the law.

### INSPECTION OF IMPORTED FOODS AND DRUGS

All consignments of foods and drugs offered for entry into the United States from foreign countries come within the jurisdiction of the Federal food and drugs act. The act provides that all consignments found to be adulterated or misbranded within the meaning of the act, or that are otherwise injurious to health, are to be excluded from the country. Inspections are made, in so far as the limited personnel available will permit, of the foods and drugs offered for entry at the leading ports. Since it is not practicable to inspect all consignments, it is the aim to center attention on those which there is reason to believe may be adulterated or misbranded. However, it is not possible to inspect ade-

quately even all the consignments which may be in violation of the law. Certain classes are selected from time to time to receive attention, and the means available are used to the utmost to find as many as possible of the consignments that are in violation of the law.

### COURT DECISIONS

The following court decisions rendered during the year are of interest:

The United States Supreme Court ruled that a label reading "Apple Cider Vinegar Made from Selected Apples," applied to vinegar made from dried-apple products, was a misrepresentation with respect to such vinegar. This reversed the decision of the Circuit Court of Appeals for the Sixth Circuit, which was reviewed by the Supreme Court upon proceedings instituted by the Government. In rendering the decision the court said:

The statute is plain and direct. Its comprehensive terms condemn every statement, design, and device which may mislead or deceive. Deception may result from the use of statements not technically false or which may be literally true. The aim of the statute is to prevent that resulting from indirection and ambiguity, as well as from statements which are false. It is not difficult to choose statements, designs, and devices which will not deceive. Those which are ambiguous and liable to mislead should be read favorably to the accomplishment of the purpose of the act. The statute applies to food and the ingredients and substances contained therein. It was enacted to enable purchasers to buy food for what it really is.

On an agreed stipulation of facts, the United States Court for the Western District of Virginia held that the sale of an artificial mixture of cultivated oats with wild oats and other foreign material under a designation "Sample Grade Star Oats" was a misbranding in that the article was sold under the distinctive name of another article.

The Court of Appeals of the District of Columbia has reversed the judgment against the United States in a seizure proceeding against a certain brand of pills which were alleged to be falsely and fraudulently labeled as to their curative and therapeutic effect. The appellate court held that the trial justice committed error in not permitting the Government's expert witnesses to testify as to the consensus of medical opinion upon a given subject.

The United States Pharmacopœia prescribes that "powdered colocynth" must be made from colocynth pulp containing not more than 5 per cent of seeds. The United States Court for the Eastern District of Pennsylvania has held that colocynth apple ground

with approximately 25 per cent of the seed and labeled "powdered colocynth apple" is misbranded. Although it is not expressly stated that the product is what is known to the trade as "powdered colocynth," but is stated to be "powdered colocynth apple," the court held it is none the less true that the difference in the product is not so stated as to command attention to the fact that there is a difference. The product is so labeled that the difference may be overlooked and the purchaser may be buying the product with the thought that he is buying another. Because of its ambiguity such branding was held to be misleading.

### COOPERATION WITH STATE AND CITY OFFICIALS

The effectiveness of cooperation with State and city food and drug officials was demonstrated in the case of the recent poisoning outbreaks caused by ripe olives. Immediately upon the conclusion of the investigation of the Bureau of Chemistry, which proved that the fatalities in Wyoming had been caused by canned ripe olives, letters were sent to every State official charged with the enforcement of regulatory food laws, and to similar officials in the larger cities, advising them of the results of this investigation and, in view of the great danger to the public, requesting their assistance in surveying immediately, so far as practicable, all stocks of ripe olives in the hands of jobbers, wholesalers, and retail dealers and removing all packages which were in any respect suspicious. Supplementing these letters, the field stations of the Bureau of Chemistry addressed similar requests to the health officials of many cities, large and small, within their territories. The response to these requests was immediate, and the bureau was very soon receiving samples of olives from every section of the United States. These were examined and reported upon as fast as possible. The bureau gratefully acknowledges this prompt response to its appeals and the able assistance so effectively rendered by State and city authorities, which resulted in segregating and eliminating from the market olives wholly unfit for sale and consumption.

During the past year attempts have been made to supplement the usual co-operative work by a plan for more closely coordinating the administrative procedure of all food and drug officials. Tentative uniform rules and regulations have been devised and even adopted in two sections of the

United States, and they are under consideration by other groups of food and drug officials. It is believed that this endeavor should be continued, since the adoption of a uniform method of procedure by all concerned will not only prove effective from a regulatory standpoint, but ought to appeal to the food manufacturer, who must arrange his labeling so as to comply not only with various local laws and ordinances, but with the terms of the Federal food and drugs act.

#### PUBLICATIONS ISSUED

Five department bulletins, 4 farmers' bulletins, 2 miscellaneous circulars, 7 articles in the Journal of Agricultural Research, 125 articles in scientific and technical journals, and 700 notices of judgment were published during the year.

The department bulletins were: No. 1158, "Production of Sirup from Sweet

Potatoes"; No. 1166, "Apple By-Products as Stock Foods"; No. 1168, "Wearing Qualities of Shoe Leathers"; No. 1194, "A Chemical and Structural Study of Mesquite, Carob, and Honey Locust Beans"; and No. 1203, "Experimental Production of Straw Gas."

Of the 4 farmers' bulletins, 3 were revisions of previous bulletins which were brought up to date and expanded to include much new material. The revised bulletins were: No. 1334, "Home Tanning of Leather and Small Fur Skins"; No. 1366, "Production of Maple Sirup and Sugar"; and No. 1389, "Sorgo-Sirup Manufacture." The new bulletin is No. 1424, "Making Vinegar in the Home and on the Farm."

Miscellaneous circulars No. 9, "Importation and Inspection of Tea," and No. 22, "The Naval Stores Act and Regulations for Its Enforcement," were also published.







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REPORT OF THE ENTOMOLOGIST

UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF ENTOMOLOGY,  
*Washington, D. C., September 10, 1924.*

SIR: I submit herewith a report of the work of the Bureau of Entomology for the fiscal year ended June 30, 1924.

Respectfully,

L. O. HOWARD,  
*Entomologist and Chief of Bureau.*

HON. HENRY C. WALLACE,  
*Secretary of Agriculture.*

DECIDUOUS FRUIT INSECT INVESTIGATIONS

Investigations of deciduous fruit insects have been carried out under direction of Dr. A. L. Quaintance as formerly.

JAPANESE BEETLE

Owing to increased appropriations, the work on this pest has been materially strengthened, especially the inspection of farm products and nursery stock; research activities have been broadened, and new investigations have been undertaken. Several lines of inquiry have been completed and reports prepared, or are in course of preparation.

Two years' intensive study to determine whether refrigerating soil balls about the roots of conifer plants would be effective in destroying the larvæ showed that in general when plants were subjected to low temperatures the grubs were destroyed in the soil ball, but in the case of most of the plants treated the margin of safety was so small between the temperature which would kill the grub and one which would injure the plant that this method of treatment is of doubtful value from the commercial standpoint. It was found that the larvæ could withstand very low temperatures, approaching zero in many cases, provided the changes in temperature were not sudden. On the other hand, lowering the temperature

30 or 40 degrees within 8 to 12 hours would in most cases give 100 per cent kill.

In view of the danger of distributing the grubs in soil around the roots of evergreens, extensive experiments were undertaken in the removal of the soil balls from conifer trees and then remaking the ball with uninfested soil. It was found that in the case of evergreen stock up to 6 or 7 feet in height, the soil could all be removed, the roots washed, puddled in clay, and repacked in uninfested soil, with an average loss of not more than 10 per cent greater than the average loss which occurs in transplanting the trees from one situation to another, as ordinarily practiced. With certain plants this loss is very much less; in fact the data accumulated indicate that it was very little greater than the loss occurring through ordinary transplanting; on the other hand, some less hardy species, as varieties of *Retinospora*, suffer a much greater loss from the removal of the soil ball. The cost of remaking the soil ball with uninfested soil, added to the average loss from transplanting, is equivalent to about 13 cents per tree. These tests, it is believed, point out a way of utilizing evergreen stock grown in infested regions, which otherwise might become a total loss.

A study of the effect of the more common cultural practices and the effect of different methods of fertilization upon the larvæ of the Japanese



beetle indicates that when this work is done in late fall and early spring, from 40 to 50 per cent of the larvæ may be destroyed. Experiments also indicate that by a number of cultivations during the egg-laying season of the beetles 25 to 30 per cent of the eggs will be destroyed. Experiments have been made to determine methods of treating the soil about the roots of rhododendrons, blueberries, azaleas, etc., which normally grow in heavy mixtures of peat and sand. It was ascertained that proper treatment with carbon disulphide will kill about 100 per cent of the larvæ. A large number of organic compounds were carefully compared in efficiency and availability with carbon disulphide as soil insecticides, but none of them proved to be superior.

Especial attention has been given to life-history studies and ecological investigations, including the physiology of the insect in all its stages, with special reference to environmental conditions. The object in view is to determine the probable future distribution of the insect and its reaction toward new environments when it reaches such regions as the corn-growing belt in the Middle West, the cotton region in the South, and the fruit regions in the North. Chemotropic studies with the adult beetle have been continued, and it was found that certain essential oils when sprayed on the foliage or mixed with bran and used as a bait were decidedly attractive to the beetles. Geraniol appears to be the most attractive of those tried. It is hoped that further investigations of this kind will be well worth while.

Substantial progress has been made with the study of the effect of insecticides on the beetles. The recommendation of 4 pounds of arsenate of lead to 50 gallons of water with the addition of 2 pounds of flour as a spreader, made last year, has been reduced to 3 pounds of the poison to 50 gallons of water. The relative kill resulting from the use of this material, however, is not high, probably not over 15 or 20 per cent on the average. On the other hand fairly good protection has been secured to both fruit and foliage from the repellent action of the spray. A process has been devised of coating the particles of arsenate of lead with an insoluble soap, such as lead oleate. This work has necessitated a large amount of experimentation, involving some 96 different soaps. It was found that a mixture of arsenate of lead paste con-

taining 2 per cent of lead oleate on the basis of dry weight gave the most perfect mixture from the standpoint of spreading and sticking to the foliage. Cage experiments carried out during the latter part of the summer of 1923 indicated that the beetles feed readily on leaves sprayed with this mixture. Definite control experiments in apple, peach, and cherry orchards, and vineyards, have been carried out to determine the amount of killing of the beetles which may be expected when spraying is carefully and systematically done.

Distinct progress has also been made in the study of insecticides for the destruction of grubs in the soil. Experiments have been continued on conifer nursery stock which is normally shipped with soil about the roots. A method of treating this soil while the trees are standing in the row has been developed, namely, the use of carbon disulphide applied in a dilute solution with a large quantity of water. It has been possible to obtain a kill of the grubs 24 inches below the surface. This treatment has been applied both in the fall and spring without plant injury. Further work, however, must be done to verify these preliminary results before this method can be put into commercial use.

Another method is the fumigation of the soil ball around the roots of conifer stock with carbon disulphide gas. In this treatment the tree is inverted in a tank of water to protect the top from the effects of the gas, while the roots and soil ball are exposed to the vapor of the chemical for from 6 to 12 hours. There has been no difficulty thus far in killing the grubs, and the plants have shown little injury.

Experiments have been completed on the treatment of soil in coldframes or in nursery beds to destroy the grubs. This method requires the addition of acid lead arsenate to the soil at the rate of 1,500 pounds to the acre. It has been found that the arsenate of lead undergoes certain chemical changes after being mixed with soil and has a tendency to form basic arsenates. Methods are being studied of treating the lead in such a manner as to protect it from the action of the soil and soil organisms so that it will remain in the acid condition. The use of poisons, such as arsenate of lead, in the soil to destroy the larvæ of the beetle, it is believed will have a much wider application than merely the treatment

of soil in and about nurseries. Experiments are under way to ascertain the value of such treatment in the destruction of grubs in golf greens without injury to the sod. It has also been determined that carbon disulphide emulsion is a satisfactory treatment for sod lands, golf courses, and the like to free them from grubs, and this material has already come into use on certain golf courses in the infested region.

Every effort has been made to secure the maximum number of parasitic enemies of the Japanese beetle, and to surround them with every condition which will add to the likelihood of their establishment. Seven thousand or more adults of a tachinid, *Centeter cinerea*, were released during 1923. Several days after this colony was released numerous beetles were collected in the field bearing fertile eggs of this parasite. The parasitized beetles were kept out of doors throughout the winter and the adult flies emerged from them in June, 1924. Later examinations in the field showed that many beetles had been parasitized by flies which issued under natural conditions in the field. Beetles bearing the eggs of *Centeter* have been recovered at distances of 3 to 4 miles in each direction from the point where the flies were liberated. Throughout this area of 15 to 16 square miles, parasitized beetles were fairly common during the summer of 1924. Several hundred adult dextiids (*Prosenia siberata*) were released in 1923, but down to date there have been no recoveries. The insect, however, is quite difficult to find, and it is not improbable that it may turn up even after a year or two. It is planned to release several thousand adults of the *Prosenia* parasite during the summer of 1924, from Japanese material.

Studies of the fungous and bacterial diseases of the Japanese beetle have been pushed as much as possible. Several distinct species of bacteria have been isolated which apparently cause specific diseases when inoculated into the larvæ. Twenty-nine different cultures of bacteria were distributed in field plots in the autumn of 1923, but it is impossible to determine the effect. A culture of *Isaria densa* obtained from France was disseminated in the field in 1923, and recoveries of this fungus have already been made from grubs collected in the spring of 1924. The percentage of grubs attacked, however, is small; but as the fungus becomes more widely distributed its value will, it is hoped, increase.

In cooperation with the States of New Jersey and Pennsylvania and with the Federal Horticultural Board, the prevention of spread of the Japanese beetle has been enforced to the fullest extent possible with the funds available. A revision of Quarantine Regulations 48, effective April 15, 1923, brought the city of Philadelphia within the infested area and has rendered the quarantine enforcement a much more complicated problem. During the summer of 1923 the inspection included corn, cabbage, lettuce, and grapes, which were inspected on the farm before shipment. Several hundred thousand baskets of corn were inspected during the summer of 1923 and many thousands of beetles removed from the corn before it was certified for shipment. The inspection of nursery, ornamental, and greenhouse products, soil, compost, and manure was carried on throughout the year.

Scouting to determine the limits of infestation has also been prosecuted, and it was found by the close of the season 1923 that the beetles had spread over a territory of some 2,500 square miles. During the summer of 1923 the beetles spread rapidly across the pine barrens of central New Jersey and reached the Atlantic coast, a movement which was undoubtedly facilitated by the large amount of automobile traffic moving in that direction. The spread of the beetle westward in Pennsylvania, representing an extension of area of 15 or 20 miles, was about what was expected, owing to the flight of the insect, which can not be prevented.

Owing to increase in the infested area and also to the fact that the city of Philadelphia was included in the **quarantined area**, the method of carrying out the farm-products quarantine was changed from one of inspection of products at point of origin, or where grown, to the zone system. Using the city of Philadelphia markets as a center, a zone was established within a radius of approximately 25 miles. It is probable that fully 90 per cent of the restricted farm products originating within the beetle-infested territory and coming to the Philadelphia markets is consumed in this zone. All products originating within the infested area and sent to Philadelphia markets were allowed unrestricted movement within this zone. Farm produce moving from the infested area to more distant points, as New York, Atlantic City, etc., was inspected and certified at point of origin and shipped



direct to its destination. State and Federal quarantines restricted the movement of produce from Philadelphia to points outside of the zone. The zone system worked satisfactorily during the season of 1923.

However, it was found that when an unrestricted movement of farm products was permitted from the infested area to the Philadelphia market, thousands of beetles were carried to the market daily in corn and other produce. In the market district the nature of the commission business renders it impossible to segregate produce originating from various points. It is thus possible for most kinds of produce emanating from the Philadelphia market to become infested with the beetle. Inspectors' reports made during the summer of 1923 showed that the beetles were to be found in gutters and streets feeding on garbage as well as on produce inside of the stores and on the pavements in the market. Beetles were collected in baskets, crates, and other containers of potatoes, oranges, elderberries, etc.

In view of the impossibility of satisfactory inspection and certification of produce originating in the Philadelphia markets, it was necessary to establish an embargo, effective from June 15 to October 15, on a very large class of produce likely to be moved. The enforcement of the embargo is being carried out by placing inspectors on all important roads leading out of the Japanese beetle area at points near the boundary. Provision is also made for the inspection of certain produce shipped by railroad freight and which is permitted to move after inspection and certification.

Philadelphia represents the center of one of the largest nursery and greenhouse districts in the United States and nearly all types of nursery business are represented in this region. There are in the area now under quarantine approximately 1,500 nurseries and growers of ornamental plants. Approximately half of the nursery stock grown in the restricted area consists of evergreens. Large quantities of outside-grown perennials, such as phlox, iris, dahlia, peony, etc., are propagated and shipped from the quarantined zone. In view of the great danger of distributing the insect over long distances by means of nursery stock, especial attention has been given to this phase of the work, and so far as known the long-distance spread of the beetle has thus far been prevented.

## GRAPE INSECTS

Investigations of grape insects in cooperation with the Ohio Agricultural Experiment Station, with headquarters at Sandusky, have been continued as during last year. Especial attention has been given to the grape leafhoppers, which continue to be the most abundant and destructive insects attacking the grape in that district at the present time. Particular attention has been given to tests of equipment for more thorough and rapid applications of spray mixtures. It has been found that a converging spray is most effective. Numerous types of spray booms designed for leafhopper control have been tested and boom attachments developed which show more satisfactory results than by trailer or hand-nozzle spraying, and the labor expense is much less. Few eggs of leafhoppers hatch from leaves which have been covered on the lower surface with spray mixtures containing 40 per cent nicotine sulphate at a strength of 1 to 1,200, and the number of eggs destroyed was apparently in proportion to the amount of covering secured by the spray solution. To be effective, applications must be made with great thoroughness. Tests made indicate that nicotine sprays should be applied somewhat earlier than heretofore.

Further observations have been made on the possibility of using nicotine dust in the control of the grape leafhopper. Results in general compare favorably with the results obtained with liquid applications of nicotine, especially if the dusting machine is followed by a spring-tooth harrow, which buries many of the nymphs that have fallen to the ground from the effects of the dust.

Critical life-history studies of the grape leafhoppers have been continued and are now practically completed. They include a physiological comparison between species, correlated with structural and ecological characteristics. Attention is also being given to other grape insects, as the grape-berry moth and the rose-chaffer.

## NUT INSECTS

Studies of nut insects have been continued, as previously reported, at French Creek, W. Va., at Thomasville, Ga., and at Brownwood, Tex. At the French Creek station, life-history studies have been completed of several of the nut weevils, and preliminary experiments carried out with control measures. These studies include the



larger and lesser chestnut weevils and hazelnut weevil. Experiments in spraying chestnuts for the control of the chestnut weevil have been carried out in cooperation with the Bureau of Plant Industry at the department's chestnut orchard at Bell Station, Md. This work has not proceeded far enough to permit conclusions. Biologic studies of the hickory twig-girdler have also been given special attention in view of the serious injury which this insect has occasioned in the Carolinas and Virginia. Experimental control work in nurseries at Petersburg has also been carried out.

Among pecan insects, the pecan nut case-bearer has received special attention. Knowledge of its life history has been pretty well rounded up. Many experiments with arsenical sprays have been carried out in pecan groves to determine their value when applied at different times and at different dosages. The control of the insect is considerably complicated on account of the sensitiveness of the pecan to arsenical sprays. Experiments were also carried out in the testing of various other materials, such as oil emulsions, for possible use on trees while still dormant. No very satisfactory results have been obtained. The pecan weevil, which is quite injurious locally, has been the subject of careful study both from the biologic and control standpoints. Preliminary results indicate that the beetles can be killed by arsenicals while on the trees during August and September. The larvae or grubs in the nuts, it has been found, will succumb to proper dosages of carbon disulphide. A goodly number of parasites of the insects attacking pecan have been studied from time to time as opportunity offered, and it is possible that some means may be found of encouraging them.

#### PEACH INSECTS

The third year's work on the biology of the plum curculio was completed during the fiscal year 1924 at the Fort Valley, Ga., laboratory, maintained in cooperation with the Bureau of Plant Industry and the Georgia State Board of Entomology. It was found that only one generation of this insect occurred in Georgia in 1923, whereas during the preceding two years two generations each season were found. This difference is thought to have been due to the late spring of 1923, which delayed overwintering beetles in leaving hibernation and prolonged the pupal stage in the soil. Results of

four consecutive seasons' life-history studies in Georgia will be brought together at the close of 1924 and will form the basis of an unusually complete report on this important peach pest.

Peach spraying and dusting experiments were carried out in orchards in cooperation with growers, as heretofore. This work substantiated conclusions announced in Department Circular 216. Work to determine the possibility of after-harvest control of the plum curculio was concluded during the year and the results published in Department Bulletin 1205. In connection with these curculio studies, much assistance has been rendered orchardists by advising them of the proper spraying and dusting materials, dates of application, etc., according to varying weather conditions. A method of curculio control long recognized as of value, but which appears never to have been demonstrated experimentally, is the picking up of infested dropped fruits. This investigation, under way for some seasons, has shown conclusively the great value of this procedure, especially during years of unusual abundance. It approximates in importance the use of arsenical sprays.

Further studies of paradichlorobenzene for peach borer control, especially the use of the chemical on young trees, have been made. It appears that the material can safely be used on trees 4 years of age and over.

#### SAN JOSE SCALE

Experiments with the use of lubricating-oil emulsions for the control of this and other scale insects have been carried on at several of the field stations. At the Bentonville, Ark., laboratory, where this emulsion was first extensively tried out, the results of previous years as to its efficacy have been confirmed. A very large amount of the emulsion has been used in this section, and the serious infestation of the scale on apple of a few years ago has been brought under complete control. There has also been an important saving in the fruit-growers' spray bill by the use of this preparation as against other scale washes, such as lime-sulphur.

At the Yakima, Wash., laboratory experiments with the oil emulsion indicate that when used at 3 per cent strength it is satisfactory in killing the winter eggs of the European red mite and other mites. Under Pacific Northwest conditions a 3 per cent emulsion is also necessary for the effective control of the San Jose scale.

An emulsion made with casein has been found to be practically as effective as other types and is somewhat simpler to handle. Such emulsions are more stable when mixed with the hard waters generally used in that section in spraying operations. A miscible oil made from a light lubricating oil has been developed which will be useful to orchardists under some conditions. The method of preparation involved is essentially that employed by various manufacturers of miscible oils.

At the Fort Valley, Ga., laboratory the workers tried to find whether the 2 per cent emulsion would be effective in the control of the San Jose scale on peach and not injure the trees. Extensive tests have now been made over a two-year period with most excellent results in killing the insects and without producing any injury to trees. This spray has come into much favor with the peach growers in Georgia since it is less disagreeable to use than lime-sulphur and is more effective and cheaper than other dormant sprays.

The oil emulsion is also being tested for the San Jose scale on various plants at the Vincennes, Ind., laboratory, in cooperation with the Purdue University Agricultural Experiment Station. It has been found that a wide range of oils give good results. No injury to trees has resulted, except to a limited extent with some improperly prepared emulsions. Further experiments during summer indicate that every effort should be made to effect treatments during the dormant season, since the oil on foliage results in some spotting of the fruit and some injury to the leaves. Incidentally it was observed that such trees, when dusted later, held the dust to a remarkable extent. Summer spraying of peach with the emulsion is unsafe.

#### CODLING MOTH

This insect, while not receiving the former amount of attention at field stations, has been nevertheless the subject of some experimentation as at the stations at Yakima, Wash., and Bentonville, Ark. At Yakima a large number of experiments were carried out by spraying apples in the laboratory and transferring newly hatched larvæ to them in order to obtain detailed information on the poisoning of the larvæ just hatched. In these tests the addition of a casein spreader to arsenate of lead improved the control.

At Bentonville, Ark., limited spraying experiments have been continued to clarify certain points in the control of this pest, which continues to be very destructive in that region in certain years. Fruit growers on the whole, however, are well acquainted with the most up-to-date methods of spraying, and the situation has greatly improved during the last few years.

#### INSECTICIDE INVESTIGATIONS

The investigation of miscellaneous insecticides has been continued at the laboratories in Washington and at the near-by field station at Silver Spring, Md. In addition, cooperation is in effect between the Washington laboratories and various field stations of this section in testing various new or improved preparations on a commercial scale. A thoroughgoing study of oil emulsions has been begun, and important progress has been made, especially toward increasing the stability of emulsions in hard water and lime-sulphur solutions. This complicated project will require several years for thorough work, but it is believed to be very important. The cooperative project on organic contact insecticides with the Insecticide and Fungicide Laboratory of the Bureau of Chemistry has been continued. Some of the chemical results of this cooperation have been published in the *Journal of the American Chemical Society* and a report is now in course of preparation on the insecticidal phase.

In cooperation with the Chemical Warfare Service, work is being continued with the so-called war gases and other materials developed at the Edgewood, Md., arsenal. A large number of these substances have been tested and a few found which give promise of value. A smoke candle for use in greenhouses has been developed and is being tested on a commercial scale. It would appear to have a distinct place in greenhouse insect control work.

Investigations at the Silver Spring, Md., laboratory, in cooperation with the Office of Truck Crop Insect Investigations of this bureau, have developed what appears to be a new contact insecticide which will in many instances be a suitable substitute for nicotine and will cost notably less. This insecticide mixes well with oil emulsions, and it is believed will make an excellent spray for the delayed dormant treatment for the simultaneous control of the San Jose scale and apple aphids.



## WORK ON THE GIPSY MOTH AND THE BROWN-TAIL MOTH

This work has been continued throughout the year under the direction of A. F. Burgess.

At the beginning of the fiscal year it was apparent that, with the funds available for field work, it would not be possible to carry through the plan of scouting and cleaning up a strip of territory surrounding the area known to be infested with the gipsy moth in Maine, New Hampshire, Vermont, Massachusetts, and Connecticut, and to examine a strip of towns some 20 miles wide extending from the Canadian border directly east of New York State line through the States of Vermont, Massachusetts, and Connecticut to Long Island Sound. A rough survey of this strip, together with the adjoining area in New York east of the Hudson River, indicated that on account of the somewhat level and moderately rolling country, and the sparse distribution of trees in a large portion of the area, it was more suitable to maintain as a clean area to prevent the spread of the gipsy moth westward, than any of the adjoining country toward the east.

The border work in Maine, New Hampshire, and northern Vermont was abandoned and all efforts concentrated on scouting a strip approximately 20 miles wide adjoining the New York State line. A contiguous strip in New York was to be scouted and treated by the conservation department of that State, under an initial State appropriation of \$150,000. The purpose of this work was to determine whether the insect had become established in this area and to clean up all infestations so that westward spread might be checked.

To the westward of Lake Champlain and the Hudson River are located the Adirondacks and other large mountainous areas linked with the Appalachian system where it would be practically impossible to carry on extensive scouting and clean-up operations, and if these areas should become generally infested rapid spread to the west and south would be inevitable.

The scouting work was continued throughout the fall and winter. Gipsy moth colonies were found in 10 new towns in Vermont and 4 in Connecticut. The conservation department in New York located colonies in 9 towns east of the Hudson River. The size of these colonies varied from a single egg cluster to 1,000 or more. In the

town of Alburgh, Vt., within a mile of the Canadian border, a small wooded area was found that was heavily infested. This was a direct threat not only to Canadian territory but to the Adirondack forest reservations in New York.

The cost of completing the scouting in the area handled by the bureau was greater than the original estimates and it was imperative that the infested area be thoroughly treated. It was also necessary that scouting and spraying work be conducted at Greenport and Patchogue on Long Island. To complete this necessary work, deficiency funds amounting to \$70,000 were made available April 2, 1923. As a result, the Long Island work was completed as planned, and all the infested areas were thoroughly treated and sprayed.

The season was abnormally late in New England and there was a heavy rainfall during June. On this account the spraying was not as effective as usual, although some of the areas were sprayed twice.

The work in New York progressed satisfactorily except that with the funds available it was impossible to scout all of the towns before spring. The colonies that were found were thoroughly treated and sprayed, and a decrease in the number of infestations is anticipated for the current year.

Heavy expenditures will be required during the coming year if this zone is to be finally established and maintained. The areas that it seems necessary to work intensively have been determined, and the costs can be estimated with reasonable accuracy. In the opinion of all experts who have given the project close study the opportunity is now available effectively to check the spread of this insect. It can not be done with inadequate funds, and if the amounts that are required are not available the attempt should be abandoned. Any course that promises less than adequate control will be expensive and unsatisfactory.

## FIELD WORK IN NEW JERSEY

The infested area in New Jersey has been reduced 50 square miles during the fiscal year and is now half the original size. Progress is also shown by the decreasing number of infestations and of the number of egg clusters that were found.

Difficult and expensive work yet remains to be done along the rivers flowing through the infested territory, and on the Watchung Ranges north of Boundbrook and Somerville. The



river banks in many towns are edged with birch, elm, and willow trees, many of which have large cavities or rough bark in which egg clusters of the insect may easily be concealed.

During the year trees on 500 acres of this territory have been cut and the brush and debris removed so that thorough work can hereafter be done at moderate cost. Substantial areas of similar character must be treated in the same way before the infestations in such sections can be eliminated. Infestations in tall trees and on the ridges which are heavily wooded have been especially difficult to deal with. Material progress has been made, but complete eradication of the insect will require more time in such areas than in the more sparsely wooded sections. The progress that has been made in New Jersey is very encouraging.

#### QUARANTINE AND INSPECTION WORK

During the year the Federal Horticultural Board has promulgated more rigid regulations in order to compel owners of nurseries and premises from which forest and quarry products are shipped to keep them free from gipsy-moth infestations. This has increased the work of the inspection force very materially. The extension of the quarantined area to include towns that were found infested during the previous year has added to the volume of work. During the fall of 1923 embargoes were laid by several States designed to prevent entry of Christmas trees and greens from New England. Later some of the embargoes were lifted, and the volume of these products offered for inspection was unusually heavy.

In the spring of 1924 most of these embargoes were removed by the States, and it is probable that the volume of shipments will be greater in the future.

The total number of shipments inspected and certified during the year was 106,224. In addition to this, 657 permits were issued.

#### FIELD AND LABORATORY RESEARCH WORK

Successful control of any insect pest requires constant experimental work in order to devise better methods and to take advantage of changed conditions as they develop. For several years the results of spraying on certain classes of foliage, particularly white oak and coniferous growth, have not been entirely satisfactory because the poison has failed to adhere firmly

to the foliage. The best stickers and spreaders that could be obtained were used, but the results were not entirely satisfactory if there was heavy rain during the spraying season. As a result of experiments with various substances, carried on during the past three years, it has been demonstrated this summer on large field plats that the addition of 1 quart of raw linseed oil, light-pressed fish oil, or corn oil to each 100 gallons of arsenate of lead spray caused the poison to adhere firmly to the foliage. Best results were secured with the linseed oil, but the other two mentioned are nearly as good. The fish oil is least expensive, but the cost of any of these materials is not prohibitive.

The effectiveness of spraying will be greatly increased by using one of these oils.

Very valuable data relative to retardation of growth of different species of trees due to defoliation are being secured and compiled, and many records of scientific value are being secured at the laboratory.

During the spring and summer three experts from the Melrose Highlands, Mass., laboratory have been engaged in studying the gipsy moth and its natural enemies in European countries, and temporary laboratories were used in Spain, Hungary, Serbia, Bulgaria, and Poland. Many other countries were visited, but the more important infestations were located in the countries named. A number of local entomologists were employed temporarily, and as a result nearly 90,000 parasites of several different species were shipped to America. These were cared for at the Melrose Highlands laboratory, and it is hoped that this will result in the establishment of several new enemies of the gipsy moth.

Aside from handling these importations, the laboratory has continued the work of colonizing parasites in the infested area in New England and New Jersey, and by means of check collections has determined the abundance of the different species that have been colonized heretofore. This work indicated that parasites and natural enemies of the gipsy moth were more abundant and effective this season in New England than ever before. The results were particularly noticeable in the area that has been infested the longest.

It is desirable that the parasitic and other experimental work be developed as rapidly as possible.

### GENERAL SUMMARY

The brown-tail moth continues to increase and cause damage in the seacoast towns in New Hampshire and southwestern Maine. There are also some serious infested localities in the Merrimac Valley region in New Hampshire. Throughout the rest of the territory the insect is local and the damage slight.

The gipsy moth has been less abundant in the generally infested territory than for many years. A number of large defoliated areas were reported in Maine, central New Hampshire and southern Massachusetts. In New Hampshire and Maine there was a rather high mortality of the eggs during the winter due to excessive cold. This condition was local rather than general, but in some localities was an important factor in reducing the increase of the species.

Hand-control methods, particularly spraying, have been an important factor in gipsy-moth reductions in many of the cities and towns.

In the country districts and wooded areas the beneficial results due to the parasites imported by the bureau can be easily seen. Because of these conditions the time was never more opportune to do effective clean-up work and to prevent the spread of the insect in the border territory. The work is organized so that effective results can be secured. The undertaking must be conducted on a large scale and can not succeed unless ample funds are available.

### CEREAL AND FORAGE INSECT INVESTIGATIONS

Prof. George A. Dean has been in charge of this section during the year.

#### EUROPEAN CORN BORER

The most important developments of the past year have been the appearance of the pest on the western end of Long Island in the borough of Brooklyn and the intensification of the infestation in the Ohio area at the western end of Lake Erie. In Long Island the infestation is located close to an important sweet corn producing section where a large part of the corn consumed in the New York market is grown. The principal danger lies in the possibility of infested sweet corn moving to the New York markets and thence possibly to other parts of the United States. With this danger in mind, a determined effort was made during May and June, 1924, to reduce this infestation to a mini-

mum by burning over the infested plants and weeds with the use of a specially designed oil-burning apparatus and by subsequently spraying the weed areas with arsenical weed killers in order to destroy such developing larvae as remained subsequent to the burning. It is hoped that the danger of spread has been largely reduced.

In order to meet the increasing abundance of the pest in northwestern Ohio and along the lake shore throughout that State, a comprehensive control campaign was worked out in co-operation with the Ohio State Extension and Farm Bureau organizations, resulting during April, 1924, in the conduct of a large scale clean-up campaign throughout the infested counties. Unfortunately, the weather during the period was most unfavorable, but much painstaking and thorough work was done which it is hoped will help to retard the invasion of the Corn Belt by this serious pest. Small infestations of the corn borer also developed in eastern Connecticut which were thoroughly cleaned up under the supervision of the State entomologist.

Progress has been made in the work of importing the insect parasites of the corn borer from its original home in southern Europe. One of the parasites liberated in the United States during 1922 has been found to have survived two winters in New England, and, as one of these was unusually severe, it is believed that it has become firmly established there. During the summer of 1924 colonies of this promising parasite were liberated in western New York and in Ohio, where conditions for its development are believed to be favorable. It is hoped that it may speedily become established there, although it is realized that several years must elapse before concrete results of its work can be expected. Additional parasites are constantly being found and studied in the parasite laboratory at Hyères, France, before attempts are made to introduce them into the United States.

#### THE ALFALFA WEEVIL

Although the alfalfa weevil has continued to spread, it is becoming apparent that an imported parasite is spreading practically as fast as the pest itself. Colonies of this parasite were liberated in Colorado in 1918 and in Nevada in 1921, and it is known to have become established in these States. The introduction of other important parasites is proceeding rapidly. Department Circular 301,



summarizing the parasite introduction work, was issued during April, 1924. The application of arsenates in spray for the control of the weevil has been practiced with success in Utah for several years, although this method has not been thoroughly perfected for use in Idaho and other States where the climate and altitude differ. As the procuring and hauling of water in connection with this method of control have involved a heavy item for labor in this irrigation region, it has seemed desirable to perfect a method of dusting which would eliminate this necessity. It is believed that such a method is now ready for application and a publication on this subject is being prepared.

There is great need of a thorough survey to determine the present distribution of the alfalfa weevil in the United States, but this work can not be done with the present limited resources.

#### GRASSHOPPERS

The burden borne by the wheat growers of the spring wheat belt during the period 1919-1923 was made doubly heavy by the occurrence of severe grasshopper outbreaks throughout most of this region. As a result of numerous requests for aid, Congress appropriated funds in 1921 requesting a special investigation of the grasshopper problem, and the bureau responded by placing an expert at Fargo, N. Dak. This station later was transferred to Billings, Mont. With the aid of the State agricultural organizations and experiment stations, great campaigns were waged against the pest in the Dakotas, Montana, Colorado, and Wyoming, with the result that millions of dollars in wheat and alfalfa were saved and at the present writing these outbreaks have largely subsided. The vigorous control efforts initiated by State and Federal entomologists are believed to have contributed importantly toward the suppression of these outbreaks.

An outbreak of grasshoppers in central and northern Texas which caused great anxiety in 1923 threatened to recur during June, 1924, but preparedness on the part of State extension workers, farmers, and Federal entomologists enabled them to gain control before serious damage occurred. A threatened outbreak in Oklahoma was also overcome.

#### SEED CHALCIS IN ALFALFA

The growing of Peruvian alfalfa seed in Yuma valley in Arizona and

California, which has become an important and profitable industry during recent years, has received a severe setback by the work of the alfalfa seed chalcis, which is a minute black wasp. This insect stings the developing pods and lays an egg in each seed. The resulting maggot devours the interior of the seed, entirely destroying its contents. Very heavy losses have resulted from the work of this pest in the Yuma valley and the seed growers asked Congress at its last session for aid in overcoming the pest. On July 1 the sum of \$5,000 became available and an expert was assigned, with headquarters at Yuma, to investigate this problem.

#### WIREWORMS

These subterranean insects usually have been considered as normally inhabiting grasslands and uncultivated soils, but in the Yakima Valley of Washington this has proved not to be the case. For several years past the injury to many crops by wireworms has been increasing, and the worst infestations observed in most cases have occurred in irrigated lands which had been longest under cultivation. The situation became so acute in 1923 that the growers in the Yakima Valley contributed immediate funds and requested aid from Congress in order to secure an investigation of the situation. On July 1, 1924, Federal funds became available for this work and an investigator was assigned to study the pest. The chief crops affected are potatoes, alfalfa, corn, nursery stock, and sugar beets. It is probable that several years' work will be required before the discovery of satisfactory control measures can be expected.

#### HESSIAN FLY

Although this well-known pest for several years past has been held in abeyance in the greater part of the winter wheat producing regions, it appeared abundantly during the summer and fall of 1923 in the extreme western and northwestern counties of Kansas and in northeastern Nebraska, where previously it had not been known to be injurious or even present. The wheat was heavily attacked by it in the fall and gravely threatened by its work. Fortunately, however, growing conditions stimulated the wheat in the spring and subsequent dry weather killed the eggs of the Hessian fly. At the present writing an excellent crop in this region is promised.



## SORGHUM MIDGE

The sorghum midge continues to be the limiting factor in the production of grain sorghum for seed in the interior of Texas. A method of control has been discovered and is being tested on a large scale previous to announcement for general application. This is a cultural method which it is believed will prove both safe and practical.

## STORED PRODUCT INSECT INVESTIGATIONS

Investigations in this section of the bureau work have continued under the leadership of Dr. E. A. Back.

The investigation of weevils attacking beans and cowpeas in California has been continued with gratifying results. Five papers containing data new to science have been prepared and submitted for publication. Experiments have definitely proved that the planting of weevily beans and cowpeas has no effect upon the infestation of the succeeding crop. This corrects a widespread and erroneous idea that the planting of weevily beans is the cause of a weevily bean crop.

On the other hand, it has been as conclusively demonstrated by laboratory work and by field experimentation, including considerable acreages of commercially grown beans and cowpeas, that the infestation of maturing crops is due to the development of immense numbers of weevils in seeds held over from the preceding years and left neglected in storage near fields of growing beans. Over 350,000 four-spotted cowpea weevils (*Bruchus quadrimaculatus*) developed from one sack of 69 pounds of black-eyed cowpeas.

This work of the bureau has been followed by the bean growers with much approval and in one of the most important bean-growing sections has resulted in the formation of a bean-weevil committee, the purpose of which is to disseminate the new information secured by the department and to enforce recommendations which it feels certain will very greatly reduce the losses which bean growers are sustaining, and which have been steadily increasing with the continued culture of these leguminous crops.

With the passage of the grain standardization act the importance of insects in grain at grain terminals has been enormously increased inasmuch as the discovery of living weevils by the Federal inspectors reduces the grade, and frequently lessens the cash

value of a carload lot by \$250. Elevators have resorted to fumigation with carbon disulphide, at the expense of the shipper, to kill weevils and return grain to the grade to which it would belong were no living weevils found. This procedure was prohibited, except at New Orleans and Baltimore, early in 1922 by the action of the General Managers' Association of Chicago (representing the leading railway systems of the United States) because of the fire hazard associated with the use of carbon disulphide.

At the request of this association cooperative work was started between the Bureaus of Chemistry and Entomology with the result that over 100 volatile organic compounds have been tested. Thirty compounds have been found more toxic to the rice weevil than carbon disulphide, but fumigations of weevils in wheat in grain cars in railway yards under practical conditions left only two promising fumigants—ethyl formate and ethyl acetate. It was soon discovered that the commercial grades of ethyl acetate showed odoriferous constituents of low volatility that were carried through to the flour and the finished loaf. Further work has demonstrated that this objection to ethyl acetate is overcome if a pure grade is used. At present experiments with a 40-60 volume of pure ethyl acetate and carbon tetrachloride in amounts of 40 to 50 pounds per carload of grain indicate that a noninflammable, non-explosive, and effective fumigant has been found to displace carbon disulphide where fumigation with the latter can not be safely done.

Work with fumigants has progressed along other lines. A thorough study of the penetration of hydrocyanic-acid gas into sacked beans, peas, and cowpeas has demonstrated the practicability of this type of fumigation in warehouses where the use of large amounts of carbon disulphide gas might prove dangerous. The result of this work has already made hydrocyanic-acid gas fumigation the standard for warehouse control of bean and pea weevils where the seeds are sacked. Similar experiments have proved the futility of such fumigation for the control of the rice weevil, *Sitophilus oryzae*, in sacked rice and corn.

Cooperative work with the Bureau of Animal Industry has proved that cured meats can be fumigated with hydrocyanic-acid gas safely and has led to a change in Federal inspection regulations permitting the use of this gas in meat establishments. The first

commercial establishment to be fumigated under the changed rulings was at Baltimore in the fall of 1920.

The ability of various food stuffs to absorb and retain hydrocyanic-acid gas differs greatly and has been investigated in cooperation with the Bureau of Chemistry. Few substances were found to contain more than 120 parts per million of hydrocyanic-acid gas after fumigation. While flour mills have been fumigated for years with hydrocyanic-acid gas, now other establishments such as candy factories, dried-fruit establishments, and warehouses containing a wide range of food-stuffs with few exceptions feel safe in using this gas.

The manufacture of liquid hydrocyanic acid has led during the past four years to its substitution in certain flour mills, tobacco warehouses, cereal establishments, and other storage plants for hydrocyanic-acid gas generated by the pot method. Tests have indicated that it is equally effective in fumigating inclosed spaces. Experiments attempting to find in liquefied hydrocyanic acid a suitable fumigant for large columns of grain in elevator bins by forcefully introducing the liquid into the grain by means of pumps and perforated tubings have not proved very promising.

The substitution of hydrocyanic-acid gas fumigation for the use of sprays, naphthalene, paradichlorobenzene, and beating in hide and skin warehouses for the control of the hide beetle, *Dermestes vulpinus*, has been a complete success. It has been demonstrated that such fumigation does not injure delicate skins or hides and has no effect upon the tanning process. One large manufacturer of kid leather has estimated that \$100 spent in hydrocyanic-acid gas fumigation solved his insect troubles as effectively as the expenditure of \$1,000 for labor and materials formerly required to accomplish the same result.

The development of vacuum fumigation in the dried-fruit industry has been one of the features of insect control in this industry during the past four years. In California certain of the larger establishments are now depending upon this type of fumigation.

A study of the effect of fumigation upon heating grain has demonstrated that when heating is the result of insect infestation the insects can be killed and the temperature of the grain reduced to normal by fumigation with hydrocyanic-acid gas or carbon disulphide. Even grain and beans heating to 103° F. have been reduced to nor-

mal temperatures by fumigation. Such reduction in temperature prevents the continued destruction of grain in cold weather when owners, not understanding the ability of insects to raise grain temperatures, believe they are enjoying protection due to insect inactivity resulting from temperatures of 50° F. or lower.

The value of commercial cold storage as a control for stored-product pests has been made the subject of investigation, and data regarding the time and temperature combinations necessary for the destruction of insects have been obtained. Data have been secured on the effect of various temperatures upon common pests of grain, cereal foods, flour, beans, peas, tobacco, and fabric pests such as clothes moths and carpet beetles. Important variations have been found in the resistance to cold by even closely related pests such as the rice weevil, *Sitophilus oryza*, so destructive to corn in the South, and the granary weevil, *Sitophilus granarius*.

In the case of the common clothes moth *Tineola biselliella*, it has been found that if the concern merely guarantees to protect articles during the period of storage, it is sufficient to maintain a temperature of about 40 to 45° F. At this range the eggs of the moth which are apt to be on fabrics or furs at time of storage will be killed if the period of storage is prolonged over six weeks. Experiments have shown that at 20 to 25° F. and at 25 to 30° F. clothes moth eggs are all killed in about three weeks; at 30 to 35° F., in 26 days; and at 35 to 40° F., in about one month. But the older, well-grown larvæ are very resistant. While these well-grown larvæ were killed in 67 days when subjected to an even temperature of 20 to 25° F., and in 93 days at 25 to 30° F., others held at temperatures ranging from 30 to 35° F. and 35 to 40° F. are still alive after over four months.

It has been demonstrated that the well-grown larvæ of clothes moths can withstand long periods of refrigeration at moderate temperatures. In one commercial establishment where the temperature range fluctuated from 24 to 48° F. but with the temperature mostly about 40° F., well-grown larvæ withstood refrigeration for from 6 to 14 months. Even larvæ that survived refrigeration for 14 months were normal, and upon being placed in a sufficiently high temperature for feeding, resumed activity and transformed normally as though their life had not been prolonged by a forced hibernat-



ing period. These facts are important, for they explain why patrons at times have found living robust insects in articles several days after removal from 4 to 5 months in cold storage. If a fairly even temperature around 40° F. has been maintained, such a discovery is to be expected and is no reflection upon the storage firm.

Investigation of fabric pests has received much attention during the past three years. Farmers' Bulletins dealing with clothes moths (No. 1353) and carpet beetles (No. 1346) have been published. Studies of the webbing clothes moth, *Tineola biselliella*, and the carpet beetles *Attagenus piceus* and *Anthrenus fasciatus* are being brought to a close and material has been secured for technical bulletins dealing with these three pests.

An investigation has been completed, in cooperation with the Bureau of Plant Industry, which determined that chests of red cedar, *Juniperus virginiana*, can be depended upon as protectors against clothes moth attack when only very young clothes moth larvae are present at the time the fabric is placed in the chest. When properly prepared according to recommendations of the department, clothing can be safeguarded in red cedar chests. Experiments have also determined that chests of Eucalyptus and California redwood and closets lined with red cedar wood and in constant use are of no value as protectors against fabric pests; that the oils of Eucalyptus and pine are of little or no value, but that the oils of red cedar and camphor, used to impregnate chest linings, etc., have a decided value.

It has been established beyond question that naphthalene and paradichlorobenzene are among the most dependable substances that can be used in tight containers for protection against all stages of the clothes moth, thus definitely establishing the status of naphthalene when properly used and adding a new control in the form of paradichlorobenzene.

An investigation of insects attacking cured meats has been started during the past four years but has been temporarily discontinued. According to a 1921 estimate, Federal meat inspectors annually condemn \$1,000,000 worth of meat of all kinds on account of insect injury. The cheese skipper, *Piophilha casei*, is a prime pest and occasions great losses to the meat trade and to the farmers who cure small amounts of meat for home consumption. A thorough study of the biol-

ogy of the *Piophilha* fly has established the fact that during hot weather the female, which lives only 5 to 8 days, may lay as many as 500 eggs, and that the insect may pass through two generations a month. Over 52,000 skippers were reared from a 21-pound ham, over 1,200 insects leaving the ham on certain days. These facts indicate the tremendous possibilities for increase in and about meat establishments. A study of the ham beetle, *Necrobia rufipes*, has demonstrated that adult beetles may live more than 14 months, that adults may deposit as many as 2,100 eggs, and that the life cycle from egg to adult may be completed in as few as 30 days. In the control of meat pests prevention of infestation plays an important part. Papers containing information regarding the biology and control of meat pests have been prepared.

The past four years have witnessed a very severe outbreak of the Angoumois grain moth, *Sitotroga cerealella*, throughout the eastern wheat regions. Special investigation of the pest has been conducted during the past two years and has developed new facts concerning biology. The infestation of wheat in the field at time of crop maturity has been found to be much greater than was formerly believed, thus emphasizing the importance of prompt harvesting and threshing. During 1922 it was found that in a badly infested region Angoumois grain moth infestation was reduced to less than 2 per cent by prompt harvesting, threshing, and proper storage, whereas on neighboring farms when threshing was greatly delayed, infestation ran as high as 80 to 90 per cent.

The investigation of the rice weevil has continued during the last four years. The biological work conducted in Florida has been transferred to Washington. In southern Georgia a special effort has been made to determine what relation may exist between storage conditions and field infestations and whether the latter can be improved by the intelligent application of remedial measures in storage. Surveys of field infestations before harvest have been made and studied in connection with the location of farm granaries.

#### TROPICAL AND SUBTROPICAL FRUIT INSECT INVESTIGATIONS

Investigations of tropical and subtropical fruit insects have been carried out as heretofore under the direction of Dr. A. L. Quaintance.



## CITRUS FRUIT INSECTS IN FLORIDA

At the Orlando, Fla., station work on the control of scale insects and whiteflies has been continued on both a laboratory and a commercial scale, especial attention being given to oil emulsions. One formula under investigation, namely, the so-called kaolin emulsion, has proved to have distinct merit and will be treated in a forthcoming article in the *Journal of Agricultural Research* as a joint contribution from this bureau and the Bureau of Plant Industry.

Early in the year an aphid outbreak occurred in the Florida citrus belt, being first noted about Tampa. It soon spread northeastward, reaching Orlando and other points. Such an epidemic was unknown to the growers and the habits of the insect made control operations difficult. The spring growth was heavily damaged in the southwestern portion of the area. Study proved the insect to be *Aphis spiraecola* Patch, a species not before recorded on orange. It evidently had occurred in the orange belt on *Spiraea* and had adopted the orange as an alternate host. Some unusual condition had resulted in the enormous multiplication of a relatively unknown species. A study of climatic conditions seemed to give the key to the situation. In the epidemic area, February and March were very unusual—cool and wet—ideal aphid conditions. These months marked the peak of the epidemic. By June the weather had returned to the average and the June growth escaped. The future status of the insect will probably depend upon seasonal conditions in the citrus belt. This aphid is a new enemy of the orange that is capable of doing enormous damage.

## CITRUS THRIPS

Investigations of the citrus thrips in California have been continued at the bureau's laboratory at Lindsay in cooperation with the Tulare County Citrus Growers' Exchange. The thrips was not very abundant during the spring of 1923, and experimental work in orchards did not permit of positive conclusions as to the relative value of the treatments given. Beginning with the spring of 1924, a considerable amount of spraying was done in cooperation with various growers, covering 86 acres. Spraying operations were divided between applications in winter, applications in spring, and applications during both winter and spring. The biologic investigations

during the spring of 1924 resulted in the discovery of several important facts. It appears that the citrus thrips does not overwinter in trash under trees as formerly held. The insect passes the winter in the egg stage in the tenderest growth of the preceding fall. One new winter host, in addition to citrus, has been discovered, namely the pepper-tree. Several additional hosts have been added to the list and the fact noted that citrus trees continue throughout the active season as the chief supporting host of the thrips, there apparently being no marked exodus of the insect to other plants. A thorough search during the spring of the native plants failed to reveal the existence of a single native host of the citrus thrips.

## FRUIT FLIES IN HAWAII

Studies of fruit flies in Hawaii have been continued, including inspection and certification work, in cooperation with the Federal Horticultural Board. Some 2,100 inspections were made, and an idea of the scope of this work may be gained from the following figures:

Packages rejected as unfit for shipment	315
Shipping permits issued to transportation companies	1,423
Bunches of bananas passed for shipment	216,823
Crates of pineapples passed for shipment	13,470
Crates of taro passed for shipment	5,142
Crates of coconuts passed for shipment	861
Crates of ginger root passed for shipment	26
Crates of lily root passed for shipment	983

Careful attention must also be given to inspection of baggage of travelers, and this work involved the inspection of 737 pieces for passengers arriving at Honolulu from foreign ports, and leaving Honolulu for other United States ports. Beginning April 1, 1924, and until the close of the fiscal year, 832 pieces of baggage belonging to passengers leaving Honolulu for the United States were inspected and sealed. This service has proved very popular with all concerned and greatly reduces the risk of introduction of the fruit fly or other dangerous pests to the mainland in travelers' baggage.

As heretofore, records of parasitism of the Mediterranean fruit fly by its four parasites have been continued, as well as of the degree of infestation of different fruits by the insect. These records would indicate that infestation of the different host fruits

was about the same as during several years previous. Parasitism by all four species during the year 1922 was 47.2 per cent and, in 1923, 43.2 per cent, showing a decrease of 4 per cent in parasitism of all larvæ under observation. Comparing the effectiveness of the individual species in 1922 and 1923, striking differences are shown. Following are the percentages of parasitism by each species during those years: *Opus humilis*, 1922, 4.6, 1923, 4.1, difference, 0.5; *Diachasma tryoni*, 1922, 33.7, 1923, 12.2, decrease, 21.5; *Diachasma ful-lawayi*, 1922, 2.5, 1923, 1.6, decrease, 0.9; *Tetrastichus giffardianus*, 1922, 6.4, 1923, 25.3, increase, 18.9. The cause of the fall in parasitism by *D. tryoni* has not yet been determined. The large increase in parasitism by *T. giffardianus* is due to the fact that a very high parasitism by this insect was obtained from a large number of tropical almonds collected during August, September, and October from an acre in the Punahou covering about four city blocks and where, for some unknown reason, the parasite had been able to increase rapidly.

Considerable work has been done to determine the effect of cold-storage temperatures on larvæ of the Mediterranean fruit fly. Records have been secured on 80,524 larvæ of different stages which were developing in several different kinds of fruits. These fruits, containing the larvæ, were held for varying lengths of time at temperatures ranging from 32° to 40° F., when they were removed and observations made on the number of living and dead larvæ. The results of these experiments were generally the same as previously reported by the bureau. In South Africa experimenters have found live fruit fly larvæ in peaches which had been in cold storage for six weeks at a mean temperature of 33.97°. Thousands of larvæ in apples experimented with at the Honolulu station were held in cold storage at 33 to 34° and one larva was found living after 18 days' refrigeration, which is the longest record of survival at that temperature. The low resistance to cold shown by fruit fly larvæ in Hawaii is probably due to the very uniform temperature existing, since they are not subject to such variations in temperature as occur in deciduous fruit-growing sections in South Africa. Observations have been continued on the four weevils attacking the Algaroba bean and considerable progress made in a study of their

life history and the efficiency of six weevil parasites.

#### FRUIT FLIES, CANAL ZONE

At the Panama Canal station, investigations have been continued of fruit flies and other insect pests of the more important fruits, such as avocado, mango, pineapple, papaya, sour-sop, banana, etc. The insects receiving major attention were the avocado weevil, the avocado fruit moth, avocado leaf moths, citrus black fly, a coconut palm caterpillar, fruit moths attacking sour sop and cherimola, and the papaya and other fruit flies. Careful inspections were made of various fruit orchards, town sites, etc., in order to keep thoroughly in touch with local insect pests, and especially to determine whether introductions have been made in view of the large amount of traffic from all parts of the world through the canal. The need of an adequate quarantine for the Canal Zone is very apparent if it is to be maintained free of foreign pests, as well as to protect the continental United States.

In cooperation with the Office of Forest Insect Investigations, important progress has been made in the study of termites occurring in the Canal Zone and surrounding regions. Extensive experiments have been carried out in developing methods of preventing their injuries, which are quite serious under the climatic conditions there obtaining.

#### CAMPHOR SCALE

Distinct progress has been made in the investigation of the biology and seasonal history of the camphor scale. Further observations on host plants of this insect indicate that it is a rather general feeder. Observations have been made on the effect of the cold weather during the winter of 1923-24 on this insect, when the thermometer reached about 19° F., and the results will shortly be published. Considerable time has been spent in tracing shipments of nursery stock and other plants from the infested region which might have carried the pest. This work has been fairly thorough and it appears that the scale has not become established at any new points. Experiments in fumigation of the scale with hydrocyanic-acid gas at various strengths and temperatures, necessary in the movement of nursery and florist stock in the New Orleans district, have been continued



and results put in effect by local plant growers. Progress has been made in perfecting an oil spray suitable for camphor scale operations.

### GREENHOUSE INSECTS

Studies of greenhouse insects have been continued as in former years and distinct progress has been made in this field. Life-history studies of the larger bulb fly have been started and experiments conducted in the disinfection of bulbs from this insect. The larvae appear to be very resistant to vacuum fumigation with carbon disulphide at the rate of 4 and 10 pounds per 1,000 cubic feet of space. Additional information has been secured on the biology of the cyclamen mite and control experiments begun, which include the testing of nicotine, sulphur, oil emulsions, soap sprays, pyrethrum, hydrocyanic-acid gas, carbon disulphide, etc.

The Cattleia fly has continued to receive attention and additional facts concerning its life history and habits have been learned. Fumigation with hydrocyanic-acid gas has not thus far proved of value against this insect in any of its stages. Experiments are in progress with nicotine dusts and with other insecticides to develop methods of control.

The infestation by the tip moth of certain pine seedlings grown at Halsey, Nebr., led to the undertaking of experiments in the disinfection of seedlings with hydrocyanic-acid gas at various strengths, and treated plants have been returned to Halsey for planting and further observation.

Investigations in the general field of fumigation have included the testing of various dosages and exposures on a variety of plants, such as orchids and various bulbs. In tests with calcium cyanide it has been found that the killing power of this chemical for certain greenhouse aphids compares favorably with equivalent dosages of sodium cyanide. Under greenhouse conditions it was found that overnight fumigation at the rate of one-fourth ounce of calcium cyanide to 1,000 cubic feet of space gave 100 per cent kill of three species of aphids, though later tests in which the chemical was used at the rate of one-half ounce resulted in severe burning of many varieties of plants by reason, it is believed, of the extremely high humidity at the time.

Considerable attention is also being given to the general subject of insecticides from the greenhouse standpoint.

In this work experiments have been carried out with nicotine sulphate dusts, free nicotine dusts, oil emulsions, and the like.

### ECONOMIC SCALE INSECTS

Work on this project has been largely taxonomic. A large amount of identification has been made for bureau and other workers, and gratifying progress has been made in classifying and better arranging the collection. A preliminary census of the present scale insect collection indicates that there are approximately 3,000 described species, of which some 1,800 have been identified. Some 208 genera are represented out of a total of 250 genera currently recognized. Special attention has been given to the preparation of good microscopic mounts of all identified species still unmounted and of all those represented by mounts inadequate for critical study. Two papers dealing with special collections of scale insects, one from the Galapagos Islands, the other from the Canal Zone, have been prepared and the first published. A paper on the subfamily Ortheziinae has been rewritten after the inclusion of much additional matter.

### VEGETABLE AND TRUCK-CROP INSECT INVESTIGATIONS

Work in this section has been continued, under the direction of J. E. Graf. The Mexican bean beetle and the sweet-potato weevil have received the greatest amount of attention as in the preceding year. Additional tests of remedies for the control of the Mexican bean beetle have been most encouraging. Unusually good progress has been made in the eradication experiments on the sweet-potato weevil in various localities in Florida, Georgia, Alabama, and Mississippi.

#### THE MEXICAN BEAN BEETLE

The Mexican bean beetle has continued its rapid spread. As in previous years, the greatest extension of the infested area has been in a northeasterly direction, the beetle being found at the end of last summer in Columbus, Ohio. During the late summer of 1923 and the early summer of 1924, the spread continued until now the insect has almost reached Lake Erie, has been found in West Virginia near the Pennsylvania boundary, and has extended its range to the south and east to a greater extent than usual in Georgia, North Carolina,



and South Carolina. The Thomasville, Ga., infestation, which had not spread to any extent in three years, led to the belief that the insect would not thrive under the humid conditions and low altitudes found in the coastal plain areas. During the present summer, however, the boundaries of this infestation have been greatly extended and the insect has been more injurious to beans than in any previous season. It appears, on the basis of this year's observations, that our hopes that the insect would not prove a major pest in the coastal plain may be unfounded.

Biological work on the insect has been continued and has shown only minor changes in the insect's habits. Since 1921,<sup>6</sup> the insect is appearing later each year, and in 1924 it issued from hibernation 30 days later than it did in 1921. The insect apparently has not yet completed the process of adapting itself to the changed climatic conditions which are found in the humid Southeast and it is impossible to predict its behavior.

Numerous requests for assistance continued to be received from Kentucky, Virginia, West Virginia, North Carolina, South Carolina, Alabama, and Ohio, and according to the correspondents the beetle is living up to its reputation as the worst insect enemy of beans. Tests with arsenicals and other insecticides are being continued at the main laboratory in Alabama and at other points in Tennessee. In the latter State experiments were conducted in cooperation with some of the canners and it was found that the use of magnesium arsenate as a spray has given very successful control on large areas. This remedy is probably best adapted for the use of growers since most of the other arsenicals may, under certain conditions, cause some injury to the bean plants. The use of magnesium and calcium arsenates, both as sprays and dusts, has given the same successful results as in previous years.

A serious effort was made during the summer of 1923 to establish the Mexican tachinid fly parasite *Paradexodes epilachnae* in this country, but apparently these experiments have all failed. In the case of the parasites which were kept in Alabama, the flies issued and perished during the late fall after the bean beetle ceased to breed. Shipments of the tachinid puparia were sent to Melrose Highlands, Mass., and Estancia, N. Mex., for hibernation, as it was felt

that the low temperature at these places would keep the insect dormant throughout the winter. No flies have issued from any of these shipments, however, and it is presumed that they are all dead. From the parasite investigations undertaken thus far, it appears that barometric pressure may have a very important effect on the development. In view of the rapid spread of the Mexican bean beetle, it will undoubtedly be necessary to continue attempts to colonize this promising parasite in the United States, and in order best to accomplish this end it will be necessary to station a man in Mexico, in order to work out in detail the biology of the parasite and its host under Mexican conditions.

#### SWEET-POTATO WEEVIL

The sweet-potato weevil eradication work has been continued successfully in southern Mississippi, Alabama, and two of the eradication areas in Florida. The principal test project for the eradication methods under the Bureau of Entomology is the Baker-Charlton County area in northeastern Florida and southern Georgia. In this area the infestation covers parts of two counties and at the beginning of the work it included 196 infested farms, with 68 additional doubtful farms. Active eradication measures were begun in 1919, and by 1920 every farm in the entire area was under the supervision of Government and State inspectors. Since the beginning of the work 250 farms have been infested at one time or another. The greatest number of infestations was found at the time the work was initiated and has decreased considerably in each succeeding year, so that by 1923 only one farm was known to be infested at the time of the summer inspections, and at the time of the fall inspection the weevil could not be found anywhere within this area. No weevils were found in the area during the summer inspection of 1924. While two farms are still listed as "dangerous and suspicious properties," it is believed that the eradication of the insect in this test area will be attained. It will be necessary to maintain a careful patrol within this area for about two years after the last weevil has been found.

The importance of this eradication experiment can not be measured alone by the size of the affected area or by the quantity of sweet potatoes it pro-

duces. The infested zone is near Jacksonville, Fla., the principal railroad center of the State and the point through which practically all interstate shipments originating from Florida must pass. Had the infestation spread and included this point, it is quite probable that it would have been impossible to ship any sweet potatoes from Florida to other States on account of the State quarantines now in force. Aside from the fact that this experiment has proved definitely that cultural methods for the eradication of this insect are entirely successful, it has also shown that growers by careful and inexpensive farm practices may greatly reduce the degree of infestation on their own farms.

In Mississippi the work has been hampered to some extent by a lack of adequate personnel, but with the assistance of the unusually cold winter, the infestations have all been greatly reduced in intensity and considerable progress has been made in the eradication areas. In Alabama the infestation, which was most threatening to the commercial sweet-potato producing zone, has apparently been eradicated and the only farms known to be infested at present do not constitute an immediate threat to the production of sweet potatoes in southern Alabama.

Biological studies have been continued in both southern Mississippi and Florida and data of interest and importance have been added during the past year.

#### OTHER INSECTS INJURIOUS TO PEAS AND BEANS

Work on the pea aphid has been continued in both Wisconsin and California. In both places cooperative investigations with the canners and State officials have demonstrated the possibility of controlling the pea aphid under conditions of average infestation. Experiments have also been conducted to show the effect of a light attack of the pea aphid on the quality of the resulting crop, and it has been definitely proved that infestations which were hitherto considered noninjurious very definitely lower the quality of the peas. While a study of the biology and ecology of the pea aphid has been continued as formerly, the main effort has been directed toward control. The construction of the proper machinery for the application of insecticides has been one of the important problems. This

work consisted principally of the development of proper booms for distributing the insecticides under all conditions. Calcium cyanide dust has shown some control value, but it also has some toxic effect on the plants, and the investigations have not yet reached the point where it may be recommended for general farm use. Under average conditions, nicotine dust is the safest and most effective direct remedy for this insect, but since it must be used in high concentrations, the work of proper control is expensive. A machine for mechanically collecting the aphids, known as an aphidozer, has been devised during the past season and preliminary experiments have indicated that it may be of great value. This method of treatment has the advantage of being inexpensive, since the first cost of the machine, together with the labor in connection with the application, is the only expense involved.

#### INSECTS INJURIOUS TO CUCURBITS

**The striped cucumber beetle.**—Additional reports during the present season have definitely shown that the nicotine dust remedy which has been recommended by the Bureau of Entomology has been successfully used by growers. Calcium cyanide has shown a high toxicity against this insect, but unfortunately it also injures the plants under certain conditions and it is therefore impossible to give it an unqualified recommendation at the present time.

**Melon and pickle worms.**—Work on the melon and pickle worms in North Carolina has shown that these insects do not always appear together as had been previously supposed. Since one of them may be controlled, this discovery alone may lead to the development of a practical method of control for the early summer form.

**Melon aphid.**—Tests with nicotine dust have again shown that this method of treatment is much superior to the application of nicotine as a spray.

#### POTATO AND TOMATO INSECTS

**Potato leafhopper.**—During the late summer of 1923 additional experiments in the control of the potato leafhopper were conducted in Wisconsin, which definitely showed that Bordeaux spray, properly applied, will give very satisfactory control.

**Australian tomato weevil.**—Biological studies on the new Australian tomato weevil, which recently made its ap-



pearance in southern Mississippi, have resulted in working out the general arrangement of generations of this insect in the United States. Control operations have been greatly hampered by the cold weather of the past winter, which also greatly reduced the numbers of this insect in the field.

**Seed-corn maggot on potatoes.**—The seed-corn maggot appeared as a major pest of seed potatoes in North Carolina during the season of 1923. Only control measures were conducted on this insect and preliminary tests indicated that mercury bichloride used as a dip for the seed potatoes has a definite effect in repelling the insect and preventing injury.

#### INSECTS INJURIOUS TO CABBAGE AND RELATED PLANTS

**Cabbage maggot.**—Further tests with remedies against the cabbage maggot have shown that the mercury bichloride treatment is much superior to the older protective methods of paper disks, etc.

**Turnip flea-beetle.**—Nicotine dust was used as a remedy for the turnip flea-beetle on cabbage and related crops in Louisiana, and very satisfactory control by this method was obtained in the preliminary tests.

#### ONION INSECTS

**Onion maggot.**—Experiments are also being conducted in Wisconsin against the onion maggot, and the Oregon method of control by using cull sets for the attraction of the fly is being given large-scale tests. In this case also the preliminary results indicate that this method is much more satisfactory than any of the control methods used heretofore.

#### SUGAR-BEET INSECTS

Work on the sugar-beet leafhopper has been continued in California and additional points on the relationship of this leafhopper to the abundance of curly-top have been discovered. The principal work on this insect is the determination of the relation of wild hosts of the leafhopper to resultant curly-top in the sugar-beet fields. Experiments with disease-resistant sugar beets are being continued and a strain of plants has been found which shows some resistance to curly-top. No information on the possible utility of this resistant strain has been obtained.

#### WIREWORM INVESTIGATIONS

Studies on the control of cultivated land wireworms are being conducted in Washington and California. Both soil fumigants and baits have received numerous tests and the present results indicate that a combination treatment, using baits to attract the insects and following this with an application of a soil fumigant, will give an effective and relatively cheap control.

#### BERRY INSECTS

Investigations of the leaf-roller weevil, and root-aphis affecting strawberries are being continued as rapidly as the personnel will permit. A combination of cultural and insecticidal control for the weevil has given favorable results in North Carolina.

#### INSECTICIDE INVESTIGATIONS

Experiments with new and promising insecticides are under way in both Maryland and California. In the latter State a complete study of nicotine dusts as regards their composition, volatility, and effectiveness is being conducted, and tests are being made on numerous insects affecting general truck crops. At the Maryland laboratory tests of a new and promising insecticide are being conducted in cooperation with the Division of Fruit Insect Investigations. At the present time a promising and cheap contact insecticide has been developed and further tests with this material are now being undertaken.

#### GENERAL TRUCK-CROP INSECTS

**Bean leaf-beetle.**—The status of certain insects as carriers of plant diseases is being studied in Louisiana, and during the past season it has been definitely proved that the bean leaf-beetle (*Cerotoma trifurcata*) is a positive transmitter of cowpea mosaic. At the same place observations have been made on the effect of leafhoppers as regards the various types of injury caused by the different species. It has been found that some wild plants act as temporary hosts for certain species of leafhoppers and that on these plants the injuries sometimes closely resemble those which are produced on cultivated plants. This study will lead to a better understanding of the seasonal movements of some of the injurious insects and the temporary hosts involved.



**Corn earworm on tomatoes.**—Observations made on an outbreak of the corn earworm on tomatoes in South Carolina indicate that poisoned bait is worthy of further attention as a control measure for this insect. The control of the corn earworm on tomatoes by arsenical sprays has been an uncertain remedy in most of the experiments to date and the promising preliminary results obtained by the bait indicate that it may be possible to devise a more satisfactory remedy for this troublesome pest.

**Mole-crickets.**—Further tests in the control of mole-crickets have shown that the poisoned bait will give successful control when it is properly made and applied.

**Pepper weevil.**—During the summer of 1923 the pepper weevil was found to be present in several isolated areas in southern California and caused considerable damage in many instances. Preliminary observations were made on the biology of this pest.

#### SOUTHERN FIELD-CROP INSECT INVESTIGATIONS

Dr. W. D. Hunter has been in charge of these investigations, as formerly.

##### COTTON BOLL WEEVIL

Further progress has been made in the development and modification of the calcium arsenate method of weevil control, as well as in the study of other methods. Somewhat less attention was devoted to the results secured by farmers, since the use of calcium arsenate is now becoming sufficiently general to make the results more or less a matter of local and seasonal conditions. Approximately 30,000,000 pounds of calcium arsenate were used by the farmers in 1923, and a survey of results, while approximate, indicates that probably 300,000 bales of cotton were saved from the weevil by this poisoning. A more intensive study of the results of 524 farmers scattered throughout the Cotton Belt shows an average increase in yield of 396 pounds of seed cotton per acre resulting from the poisoning.

The cost of poisoning was reduced slightly by improvements in machinery, requiring less poison, and also by further experience which has been acquired by the farmers. It was found that the average number of applications for the full season's treatment was 3.4, as compared with 3.8 for the preceding season, and that the average quantity of calcium arsenate per acre per application was 5.4

pounds, as contrasted with 6.2 pounds in 1922. The prospects were very favorable for exceedingly wide-spread dusting in the cotton-growing season of 1924, and the sales until spring indicated a consumption of from 50,000,000 to 60,000,000 pounds of calcium arsenate. However, the cold weather during January, 1924, caused an exceedingly low emergence of weevils, and this was followed in the States from Alabama westward by a phenomenal drought during the period when the weevils are ordinarily multiplying most rapidly. As a result, except under purely local and outstanding favorable conditions, weevil injury has been almost totally absent from this territory, and there has been little or no necessity for poisoning. In the Southeastern States, particularly Georgia and South Carolina, a more nearly normal rainfall has prevailed, and weevil poisoning has progressed somewhat as usual.

The activities extending back several years, looking toward an increase in the arsenic supply, have finally borne fruit to the point where there is apparently an ample supply of arsenic in sight for any normal demand which can be expected, and there seems no reason why this supply can not be further expanded as demand increases.

During 1923 a great deal of attention was devoted to comparisons of different methods of weevil control under various conditions. The annual series of studies on extent of weevil damage, as measured in comparison with plats in which the weevil was thoroughly controlled by dusting, was taken as a basis for contrast with other methods. It was found that in these straight-dusted plats there was an average increase of 226 pounds of seed cotton per acre, at a cost of \$4.95, making a net profit at current prices of \$18.05 per acre. The homemade molasses mixture showed a cost of \$3.30 per acre for the season's treatment, and an increase of 86 pounds of seed cotton, producing a net profit of \$5.47.

The Florida method of boll-weevil control was studied with particular interest in Louisiana, Texas, Georgia, and South Carolina, and it was found in averaging the tests at all of these points that the total cost per acre was \$2.95, and the average increase was 36 pounds of seed cotton per acre, making a net profit of 78 cents per acre. Three of the most prominent proprietary mixtures which were being most widely used by the farmers were tested in similar comparisons.

All of these showed a net loss from their use, ranging from \$2.55 to \$10.98 per acre.

A very important event was the general survey of weevil-control methods and results at the different experiment stations, conducted by a special committee of the Southern agricultural workers, and the presentation of these figures at the annual meeting during the winter months. All records available were thoroughly studied and analyzed by this committee. From this study the most authentic recommendations to date were settled upon and standardized for use by the farmers, and suggestions for further experimental work were outlined. These suggestions are being carried out in the experiments of the bureau during 1924.

The laboratory at Florence, S. C., conducted in cooperation with the South Carolina State Experiment Station, has been continued with a particular effort toward securing contrasting records on all points where the different environmental conditions of the Southeastern States may produce any modification in results, as compared with the conditions at Tallulah, La. Various control measures have been studied in their relationship to southeastern conditions, and a special biological organization has been perfected for the purpose of a complete study of weevil biology under these new conditions. The agronomic organization, maintained by South Carolina at this station, affords a very unusual opportunity for studying those features of weevil control which involve a combination of both entomological and agronomic problems.

The most important progress has been made in the effort to locate an attractor for the weevil which, if found, may be used in some way toward control. This study is based on the fact that the weevil attacks only the cotton plant, and in all probability is attracted to this plant by some odor peculiar to it. This study is being carried on in cooperation with the Bureau of Chemistry of the Department of Agriculture, and the chemists assigned by them, after distilling many tons of cotton plants to secure the volatile chemicals present, have been working on this material in the laboratory with very promising results. Certain materials have already been isolated which give definite indications of slight attraction for the weevil, and extensive laboratory and field tests are under way with these

chemicals in the effort to locate a distinctively attractive mixture and dilution of these.

Special attention has been devoted to the relationship between the control of the boll weevil and other cotton insects. The application of calcium arsenate to cotton for weevil control of course affects many other insects, and it has been found necessary to make a complete study of this effect on the entire insect population of the plants. It has been found that decided secondary benefits arise from the control of numerous miscellaneous feeders. Particular attention has been devoted to a study of the increase in aphid infestation, which sometimes accompanies the use of poison. It has been found that this phenomenon has apparently a decided relationship to climatic conditions and also to the seasonal incidence of the poison applications. Judging from the information so far, it seems quite probable that the increase in aphid can usually be avoided by proper modification in the poisoning schedule which will not interfere with the successful control of the weevil. At the same time, a study is being made of the exact amount of damage resulting from the aphid infestation, and of the best methods of control when it actually occurs. Numerous contact insecticides have been tested, and the most effective settled upon.

The hibernation and emergence studies have been continued and the peculiar winter conditions of 1923-24, followed by the peculiar climatic conditions of the summer of 1924, have furnished an interesting series of records to round out the observations on this subject.

The studies on airplane dusting have been continued more extensively than in the past. A great deal of attention has been devoted to the mechanical features of the problem, and numerous devices for distributing the poison from the plane have been developed and perfected. It has been found that as airplanes possessing different flying characteristics are employed, it is necessary to develop different equipment, and in this way at least five distinct types of dusting equipment for the planes have been produced.

During 1923 weevil control with the airplanes was undertaken on two entire plantations, totaling about 3,000 acres, and as a very heavy outbreak of the leafworm followed on these same properties, the control of this insect was likewise included. A large



volume of figures on all phases of airplane operation for insect control were secured, and the net result of these was the definite showing that the airplane may be used to distribute poison efficiently, effectively, and profitably for the control of the weevil and leaf-worm as contrasted with the results of dusting with ordinary ground machinery. At the same time it was also found that the military airplane, which has been used solely, was not suitable for this work, and a number of airplane manufacturers were interested in the subject of developing special planes for insecticide distribution, which would be more efficient and safer than the military types which have been employed. Several of these have now been built and are being studied and developed, while the commercial possibilities have extended to the point where quite a few thousand acres were dusted commercially by airplanes during 1924 and extensive plans are under way for more widespread use of this method in the future.

The airplane dusting has led to many interesting and important developments in connection with the other lines of work, and has particularly furnished several definite leads, indicating the possibility of daylight poisoning with ordinary dusting machinery. It seems that at least a considerable portion of this effect is due to the electrical charging of particles of this dust which is produced by the plane, and a very extensive project is under way involving cooperation with the Bureau of Public Roads on the mechanical side and the Bureau of Standards on the electrical side thoroughly to work out the principles involved and their possible application to commercial operation.

New types of ground-dusting machines have been built, with special reference to some of the new principles of dusting, discovered from airplane operation, and what is apparently one of the most efficient dusting machines so far produced has passed through a considerable portion of the experimental stage, and it is hoped that it will soon be ready for commercial construction. This is the first machine which shows definite promise of being a satisfactory daylight-dusting machine. At the same time numerous other types and modifications of the ordinary grade of dusting machines have been studied, modified, and improved, all of which is constantly improving the supply of

dusting machinery on the market for use of the farmers.

Extensive studies have been continued on all phases of weevil toxicology, including development of new poisons, and particularly a thorough study of the different types of calcium arsenate in relation to their effectiveness. This is being correlated with methods of manufacture and several new methods have been studied. It is quite obvious that when this study is complete a much more efficient calcium arsenate will be available, and, furthermore, that it will be possible to eliminate materials of low efficiency which have been responsible for erratic results by the farmers in the past. Included in this study have been many suggestions originating outside the department. In fact, nearly 200 such suggested methods of weevil control have been under test in the single season.

Numerous reports of damage to game have resulted from the extensive use of calcium arsenate, and the Bureau of Biological Survey has been cooperating in an effort to determine if there is any basis for these reports. So far there seems to be no basis whatever, and there is apparently little or no chance that the ordinary operation of dusting will result in serious injury to insectivorous birds or other game.

#### TOBACCO INSECTS

In the dark-tobacco belt plant beds that have been used for more than one season very commonly develop severe infestations of the larvæ of the green June beetle. During the year methods of control have been perfected.

The tobacco flea-beetle has been more than usually injurious both upon newly-set plants and on full-grown plants. Farmers' Bulletin 1425 describes the control measures perfected during the year.

Various species of wireworms have been found attacking tobacco plants in as many as 18 of the Burley tobacco counties, in the vicinity of Lexington, Ky. The loss due to missing and stunted plants is as high as 10 to 12 per cent in some fields and is conservatively estimated at 5 per cent in many fields. The total loss runs into the hundreds of thousands of dollars. From 5 to 7 per cent of this injury has been prevented by a trap bait and at a cost of less than 1 per cent of the value of the crop.

A 1-wheel, 2-row mule duster, devised by field employees of this bureau



last year, is now being sold commercially and seems to fill the need for better dusting machinery more economically than any previous duster.

The budworm continues to be a serious pest of tobacco in the more southern of the tobacco-growing States. During the year at the Quincy, Fla., laboratory an economical method of control was worked out for the type of tobacco not grown under artificial shade.

#### SUGARCANE AND RICE INSECTS

Various observations and experiments during the year have added to our knowledge of sugarcane and rice insects. Two parasites of the sugarcane moth borer were found in Mexico, and one was brought into Texas in some numbers. The Cuban parasite released some years ago in Louisiana was found again at various plantations. The native egg parasite was observed to become active earlier in the season than was supposed, and it is evident that it is of much value.

In cooperation with the Bureau of Agricultural Economics, the damage to sugarcane in Louisiana due to the sugarcane moth borer was estimated, the Bureau of Agricultural Economics obtaining information by means of questionnaires mailed to sugar planters, and the Bureau of Entomology estimating on data from its own field examinations. These figures, obtained independently, were found to agree to a remarkable extent. The loss in 1922 was taken as 16.5 per cent, in 1923 as 23 per cent, with a normal loss of 18.5 per cent.

A mimeographed circular, which was reprinted in the sugar journals, was afterward issued. This gave the best available suggestions for the control of the moth borer and appealed for the cooperation of planters to try them out. Partly as a result of this circular it has been possible to arrange for a number of plantation experiments on borer control. The results of this work should be of great benefit.

The investigation in cooperation with the Mississippi Plant Board on a pink borer injurious to sugarcane and corn was completed. The insect is of a new genus and new species, and has been described by Dr. H. G. Dyar as *Meropleon cosmion*. It is believed, as a result of our investigation, that, though rare, this borer is a native insect, and owing to its slow development it is not to be feared as a new pest.

Wireworms were found to be very injurious in the poorly drained lands

on one plantation in Louisiana, and life-history studies and control experiments were started.

At Cairo, Ga., some information was gained on the control of ants in sugarcane fields with the object of thereby controlling the sugarcane mealybug. More experiments were started. A farmer who had adopted our recommendations as to obtaining uninfested seed cane and planting it at some distance from infested cane met with complete success, obtaining a field of perfectly clean cane.

The life history and methods of controlling rice insects are being studied. It was found that the sugarcane moth borer is more injurious to rice than is the rice stalk-borer. It was found possible to destroy 100 per cent of the newly hatched borers of both species with calcium arsenate. Grazing was found of benefit on cut rice fields, the tramping of the animals destroying the borers hibernating in the rice stubble.

A new braconid parasite was found attacking larvae of both the rice stalk-borer and the sugarcane moth borer in rice.

Efforts were made to ascertain the actual damage due to rice insects. Hibernation studies were also commenced, and some information gained as to the hibernation of the rice water weevil and the rice stink-bug.

#### INSECTS AFFECTING THE HEALTH OF MAN AND ANIMALS

##### SCREWORM

Investigations of this important pest of livestock in the Southwest have been carried on in cooperation with the Bureau of Chemistry and the Texas Experiment Station as heretofore. The discovery that benzol is admirably adapted for the destruction of the larvae in wounds has been a distinct forward step. The use of this larvicide is now being adopted by many stock raisers with better effects on the animal tissue and uniformly high killing power against the maggots, and at a cost far below chloroform or other good larvicides. Satisfactory progress has been made in the study of repellents for application to animals. The pine tar oil-furfural mixture is meeting the needs of stockmen in this direction but it is hoped to develop something which will be more healing to wounds and even more lasting as a fly repellent. Chloropierin in low dilution in mineral oil, which was first tested this year, is a very promising repellent dressing.

### CATTLE GRUBS

Studies of this destructive pest of cattle have been continued throughout the year. Control methods by the application of washes and ointments to the backs of the infested cattle have been further perfected and are now considered fairly satisfactory for use on dairy and farm animals.

The large amount of information on the cattle grubs accumulated during the last several years has been prepared for publication. These data will serve as a basis for control work which is contemplated by several States.

### POULTRY PARASITES

Further studies have been made on the sticktight flea and a large series of tests have been made with various materials fed to fowls with a view of killing or repelling external parasites. These tests were made not with any strong hope of securing beneficial results, but to gain much-needed information as to the effect of such materials on the parasites and fowls. Hundreds of thousands of dollars are being spent by poultrymen and farmers for proprietary compounds which are shown by these tests to be valueless.

### MALARIA MOSQUITOES

Experiments were conducted during 1923 to determine the possibilities of controlling *Anopheles* breeding in extensive swamp areas by means of dry insecticides distributed by airplanes. Army planes which had been equipped for cotton dusting were used and Paris green diluted with an inert carrier was employed as the insecticide. Breeding areas offering a variety of conditions, ranging from comparatively open lakes to heavily overgrown-swamp areas were treated, and it was found that when the dust mixture was properly distributed a large proportion of the larvæ could be easily and quickly killed over large areas.

An investigation was also begun in 1923 on the chemotropism of *Anopheles*, with a view of finding substances which were attractive or repellent to them.

The study of the host preference of malaria mosquitoes, which has been carried out in cooperation with the School of Hygiene of Johns Hopkins University, was continued during the year. A definite preference was shown as between certain species of animals

and an even more decided preference as between individuals of the same species.

### INSECTS AFFECTING FOREST RESOURCES AND SHADE TREES

Dr. F. C. Craighead has been in charge of this important section during the year.

A tendency toward sharper demarcation in certain forest insect investigations has been gradually developing in recent years. To meet this situation and more efficiently handle the increasing demands for assistance, it will be necessary to build up stronger organizations in the field. Already the western bark-beetle investigations and the associated cooperative control work have necessitated this step. Consequently the several field stations of the Pacific Coast States and Rocky Mountain region have been consolidated into a regional organization under the leadership of J. M. Miller, with Dr. H. E. Burke assisting in the direction of the technical investigations. The advantages of this step are already evident, allowing more direct contact between field station officers and foresters of the respective districts and permitting more prompt examination of beetle-infested areas and execution of control work.

The establishment of closer contacts with the Forest Service experiment stations is also imperative but can not be put into execution until more funds are available. A demand exists that forest entomologists be associated with these station personnels to study certain types of injurious insects that can be controlled only through the adoption of proper forestry practices. One step has been taken in this direction. Through a cooperative arrangement with the Minnesota Agricultural Experiment Station and the Lake States Forest Service Experiment Station, the services of Dr. S. A. Graham, of the former institution, have been secured to represent the Division of Forest Insects of the Bureau of Entomology. Investigations of two important forest insects have been undertaken. As soon as possible entomologists will be stationed at each of the Forest Service experiment stations.

Bark-beetle control projects have continued to demand much attention and have formed the major part of the activities of this division. Less time has been available for other investigations, and efforts along these



lines have been concentrated on problems of greatest economic importance. The more important results are as follows:

#### **THE SOUTHERN OREGON-NORTHERN CALIFORNIA CONTROL PROJECT**

The close of the past field season witnessed the successful reduction of the western pine beetle on this project to a status where the normal growth of the mature forest will more than compensate for the losses occasioned by this insect. This means an annual saving of 50,000,000 or more board feet of timber valued at over \$200,000.

This project, which was started in 1921, undertook to control the pine beetle over an area of 1,270,000 acres where the losses in the last 10 years had reached over a billion board feet of merchantable yellow pine valued at more than \$3,600,000. The operations were carried out by the Forest Service of this department, the Indian Service of the Department of the Interior, and private timber owners represented by the Klamath Forest Protective Association, under the advice and supervision of the Bureau of Entomology.

During the two and a half years of control 24,648 infested trees containing 27,976,900 board feet were treated at a total cost of \$112,818.59, divided about equally between the private timber owners and Federal Government. The cost of the work averaged \$4.57 per tree, \$4.03 per thousand board feet, or 35 cents per acre treated.

#### **THE ANTELOPE CONTROL PROJECT**

The past year marked the completion of the 3-year program on this project. On an area of 52,000 acres a reduction of 80 per cent of the infestation was secured—a saving of over 9,500,000 board feet, worth \$32,000. Not only was this outbreak successfully controlled, but this was actually accomplished at no extra cost. This was due to utilization of the treated trees and satisfactorily demonstrated the practicability of combining control work with logging operations.

#### **THE KAIBAB CONTROL PROJECT**

During the control seasons of 1922 and 1923, \$8,000 and \$10,000, respectively, were spent in fighting this outbreak of the Black Hills beetle. This work was concentrated on the larger centers of infestation where locally good results were obtained, but the outbreak over the area as a whole has developed at such a phenomenal

rate that these measures were wholly inadequate. Already nearly 750,000,000 feet of timber have been killed. During the 1924 control season the Forest Service expended nearly \$50,000 with the object of treating all infested trees over the entire area. The National Park Service is also cooperating on this project.

#### **NORTHERN ROCKY MOUNTAIN CONTROL PROJECTS**

Several successful control projects were conducted in Idaho and Montana. On the Helena National Forest one year's work resulted in a reduction of 94 per cent of the infestation in a stand of lodgepole pine.

#### **EXPERIMENTAL CONTROL PROJECTS AND BARK-BEETLE INVESTIGATIONS**

Several control projects of a purely experimental nature have been conducted. The Forest Service has given its approval of these and has cooperated with personnel and funds.

#### **THE SAN JOAQUIN PROJECT**

This project, planned to test the possibility of maintaining effective control after the major operation, has been carried through its fourth season on an area of 40,000 acres in the Sierra National Forest. Although another season is necessary to bring the work to a satisfactory conclusion, preliminary results indicate that the methods employed were effective in holding down losses during a period when natural influences favored an increase. The advantages of applying control measures to infestations of even an endemic character appear to be warranted, as the cost of the work about equaled the stumpage value of timber that was saved.

#### **THE FIGUEROA PROJECT**

This project, located near Los Olivos, Calif., was instituted to determine the possibility of entirely eliminating bark-beetle infestation from a small isolated tract of yellow pine on the Santa Barbara National Forest. This project has been under way for two seasons. Because of the high recreational values involved, success will be of economic as well as experimental value.

#### **BARK-BEETLE INFESTATION ON THE CALIFORNIA NATIONAL FOREST**

It is worth while to record a most phenomenal increase and decline in a bark-beetle epidemic on the California National Forest. During the sea-



son of 1922 over 67,000,000 feet of timber were destroyed, equivalent to 2.2 per cent of the entire stand. This was an increase of 700 per cent over the infestation of the previous year. During 1923 the epidemic almost completely died out, representing a decrease of 93 per cent. Efforts are being made to determine the causal factors involved in this remarkable condition.

#### THE ROGUE RIVER PROJECT

A more detailed knowledge of the epidemiology of the western pine beetle and the contributing factors will be of great practical importance in control and may as well afford a possibility of predicting outbreaks. Since 1914 surveys to determine the annual losses on the Rogue River drainage have been conducted with this objective in view. During the 9-year period 5.58 per cent of the stand has been killed; the annual losses have shown a marked periodicity varying from one-tenth to 1 to 2 per cent of the stand. Incidental to this statistical study, a large amount of detailed information on the bionomics of this beetle has been secured, pertaining principally to the interrelation of outbreaks and climatic conditions, the ratio of the number of progeny to attacking beetles, the effect of predators on the developing broods, the character of trees attacked, the attractive influence of forest fires, and the development of the broods in trap trees, felled trees, and slash.

#### DEFOLIATING INSECTS

The spruce budworm has not been reported in epidemic proportions in either the New England or Lake States during the past year, yet some timber is still slowly dying as the result of earlier defoliation. Recent studies indicate a decided correlation between the rate of growth of the trees and mortality from the defoliation. This result may be of much practical benefit in preventing future injury through proper forest management. The outbreaks in Wyoming and Idaho are still progressing, and reports indicate an outbreak on the Carson National Forest in Arizona. Continued studies and additional important observations have been made on several other defoliating insects—the Pandora moth in Oregon and California, the white pine butterfly in Montana, and the jack pine sawfly in Minnesota. The last-named insect is seriously threatening large areas of

jack pine in Minnesota. Some progress has been made in studying the effects of defoliation on the growth of the annual rings, indicating that it is possible to determine the dates of recent or past outbreaks from the effects produced in the growth of these rings.

#### THE SOUTHERN PINE BEETLE

The threatened outbreak reported last year developed into epidemic proportions in many States from Virginia south to eastern Texas. The losses in Virginia were particularly heavy as well as in certain portions of Mississippi. Additional information has been obtained pertaining to the susceptibility of certain types of pine forests. The lumber associations are much concerned over the losses sustained and have given much assistance in disseminating to their members practical information on control. It was impossible to conduct any demonstration in control by bureau representatives. Fewer reports of damage were received in the early summer of 1924, though it is still too soon to determine if this outbreak has actually died out.

#### INTERRELATION OF SLASH AND BARK-BEETLE OUTBREAKS

Considerable time has been devoted to investigations pertaining to the entomological aspects of slash from logging operations in the Western States. The results of these experiments will be published in the near future, showing that the slash from logging operations is not effective in furthering outbreaks of the species of *Dendroctonus* bark-beetles. In fact, breeding of the beetles in this class of material tends to reduce their numbers.

#### INSECTS AFFECTING FOREST PRODUCTS

Experimental work has been continued during the past year in perfecting methods of prevention of insect damage to crude and finished forest products. These pertained chiefly to practices involving seasoning and water submerging and to the use of chemical sprays. Several large companies have followed this bureau's recommendations, adopting certain alterations in handling their green logs which eliminated all insect injury and resulted in a big saving annually. Additional results have been secured demonstrating that usual kiln schedules for seasoning ash and oak stock will kill *Lyctus* powder-post beetle stages in the wood. Through coopera-

tion of the Division of Deciduous Fruit Insect Investigations, a series of experiments has been undertaken in Panama to determine the efficiency of certain wood preservatives and chemicals in preventing injury by white ants in the Tropics. Similar experiments conducted in Virginia, for example, might not give dependable results for the more southern climates.

#### INSECTS AFFECTING SHADE TREES AND HARDY SHRUBS

The demand for information concerning insects of this class continued to increase during the past year to such an extent that little time has been available for conducting investigations. Nearly 2,000 inquiries were answered from Washington. In California attention has been concentrated on insect problems pertaining to public parks and recreational areas. This has developed into a rather specialized field requiring methods of control less intensive than those for city trees, though greater expenditures are permissible than under forest conditions.

#### BEE CULTURE INVESTIGATIONS

The work of the Bee Culture Laboratory, under the supervision of Dr. E. F. Phillips, has been continued along the same general lines as formerly. The laboratory and experimental apiary of the bureau are located at Somerset, Md., near Washington.

#### BEHAVIOR OF BEES

The investigation of the responses of colony activity to changes in external temperature, humidity, and other factors, begun during the summer of 1921, has been continued. No additional experimental data have been collected since May, 1923, but the time since then has been spent in computing the amount of correlation existing between changes in colony weight, hour by hour, with changes in external factors. A paper has been prepared for publication recording the results of the work on changes in colony weight. Work has been begun on the calculation of the correlations of temperatures of various portions of the hive with external temperature and other changes. The work on colony-weight changes for the first time gives reliable information on the extent of the influences of various climatic factors on the honey crop and shows that a study of the physiology

of nectar secretion in plants does not completely explain the abundance or absence of nectar in plants which usually secrete it.

The investigation of the amount of brood at weekly intervals throughout the brood-rearing season is being continued with only one colony during the present season, this being a colony of special interest in clearing up certain points on which sufficient data were not obtained in earlier years. The calculations from these data have required much time and care, but the work is nearing completion. From the data obtained it has been found possible to determine the changes in egg-laying rate of queens at various times of the year, the total colony population, as well as the number of bees available for gathering nectar, the percentage of empty cells left by the queens as they pass over the brood combs, and the total number of eggs laid in a single season. The migrations of the queen to various parts of the brood-nest have also been determined. The influence of external temperature on the egg-laying rate and the differences in egg-laying of queens of various ages are now being determined. During the year a paper was prepared for publication outside the department on the egg-laying rate of queens.

The work on the responses of bees to light has been completed and a paper prepared for publication. It is found that bees do not respond invariably to light but that they are capable of modifying their behavior when kept under controlled conditions. The paper by Doctor Lineburg on larval feeding has been published as a part of Department Bulletin 1222, and additional observations on the behavior of worker bees when feeding larvæ have been made during the present season, the results of which will be published later.

Observations have been made on the number of molts of bee larvæ. It is found that during the period of larval development the larva molts four times, at intervals of about 24 hours.

#### PHYSIOLOGY OF BEES

The work on the availability of various carbohydrates as food by adult bees has been continued and the results are almost ready for publication. A similar line of work is now being carried out on the availability of these carbohydrates for worker larvæ. So far there is no information available regarding the di-



gestion of the bee larva, and it is important to determine whether the bee larva is as limited in its utilization of the more complex carbohydrates as is the adult bee. It has been found possible to use bee larvae experimentally outside of the hive, since they will live and continue development in an incubator on the foods used experimentally, provided the food can be utilized.

The work being done on the changes in the oenocytes according to the age of the worker has been continued and observations have been made of the oenocytes during larval and pupal life, for the purpose of determining whether the oenocytes of the adult bee are the same as those observed in earlier stages. The function of these cells and their significance to the bee are not yet clear.

The revision of R. E. Snodgrass's *Anatomy and Physiology of the Honeybee*, mentioned in the last report, has now been completed and will shortly be published in book form outside the department. The paper by Doctors Nelson and Sturtevant on the rate of growth of the larva has been published during the year as a part of Department Bulletin 1222. A paper on the uses of pollen by bees has been prepared by Dr. E. F. Phillips during the year.

The study of the colors of American honeys, in cooperation with the Bureau of Agricultural Economics, has been continued during the present season. Following the determinations of the transmission of lights of various wave lengths through the samples of honeys collected for this study, an effort has been made to obtain materials which will retain their colors permanently and which may be used in the making of a color grader for honeys. This has been found exceedingly difficult, for the transmission of light through honeys is effected not only by the coloring materials in the honeys but also by the degree of turbidity. It is also found that the turbidity of honeys changes considerably on standing, which complicates the making of proper graders. By taking a more or less arbitrary standard turbidity, it is possible to construct a grader which looks like honey and which gives promise of permanency, so that probably this problem is almost solved. The materials used in making graders will now be subjected to severe tests for permanency, and, if they prove satisfactory, directions will be published for their manufacture. The work on the materials in

honeys which produce the variation in color has been completed and will be published shortly.

The laboratory during the year has furnished material for a study of the constituents of royal jelly (the food of queen larvae) other than the usually recognized chemical materials. It has also furnished material for a study of the rate of mitotic cell division in the rapidly growing worker larva. These two investigations are being conducted by workers outside the laboratory.

#### DISEASES OF BEES

The paper on the distribution of the Isle of Wight disease in other countries has been published as Department Circular 287. Since its appearance, additional records of much interest have been received. The mite *Acarapis woodi*, which causes this disease, has been found in Czechoslovakia and Austria, and additional information indicates that the report of its presence in South Africa was incorrect. The only additional embargo on the importation of adult bees which has appeared during the year is that prohibiting the importation of bees to the island of Jersey from England.

The law of August 31, 1922, prohibiting the importation of adult bees into the United States, makes provision for the importation of adult bees for scientific or experimental purposes. Adult bees imported for such purposes must be shipped to the United States Department of Agriculture for examination, and if found free of all diseases of adult bees may then be sent to the person for whom they were imported. Under this provision of the law, the department has, during the past year, made importations for a number of persons who were able to qualify under the regulations. A total of 61 queenbees were imported and in none of the shipments were any mites found which cause the Isle of Wight disease. A considerable number of the shipments were found heavily infected with *Nosema apis*, a protozoan parasite of the alimentary tract of the adult bee, but, since the presence of this parasite is permitted in importations, it has not been necessary to destroy any shipments on that account. These *Nosema*-infected bees were almost all from the Province of Carniola. The reshipment of these queens to various parts of the country has been unusually fortunate, since only two queenbees have been lost



after leaving the bureau, these being queens reshipped after a long voyage from abroad which reached the bureau in bad condition. Under the regulations adopted, adult bees may be imported from Canada without restriction.

The examination of diseased or abnormal adult bees from all parts of the United States has been continued, this being done chiefly by L. M. Bertholf. During the fiscal year samples of adult bees from the United States to the number of 177 were examined but, as in previous years, no samples were obtained from any parts of the United States in which the mite causing the Isle of Wight disease was found. This work has also been continued during the remainder of the summer of 1924 and so far none of the bee samples have contained this mite. The results of the examinations for 1921 and 1922 have been published in detail in Department Circulars 218 and 287.

There recently appeared a paper by an American beekeeper giving a method whereby combs infected with American foulbrood may be disinfected and again used. This method has attracted much attention in all parts of the world, since the saving of infected combs is a great help in the control of this disease. The attention given this work has necessitated a considerable amount of investigation of the disinfecting value of various substances, as well as of various liquids to be used as carriers of the disinfectant. This work has been done by Dr. A. P. Sturtevant. It is found that it is not difficult to kill the spores of the causative organism if they can once be reached, but to obtain a liquid which serves as a carrier to penetrate the cappings of the cells containing the dead larval remains is exceedingly difficult. Beekeepers in all parts of the country have been experimenting along this line for the past year and a considerable number of them have submitted to the office samples of combs which have been subjected to various disinfecting solutions, in order that the efficiency of their methods may be checked by cultures.

Experience in the use of disinfectants under apiary conditions shows that there is need for some change in the composition of the solution, or in the method of use, which will simplify the practice, greatly lessen the cost of application, and especially make the results more positive and unvarying. The investigation now being conducted

has these aims in view and, while it is not yet possible to announce definite methods, much progress has been made. An outbreak of American foulbrood in the vicinity of Washington and in the bureau apiary during the present season has provided an abundance of material for experimentation.

During the past fiscal year samples of diseased brood have again been examined for beekeepers and apiary inspectors, a total of 966 samples having been submitted.

A study of the fungi found in the alimentary tract of the adult bee has been begun, a considerable number of species having so far been found. The significance of these fungi is still unknown, and the work will be continued.

The bee-louse, *Braula coeca*, was found some time ago in a series of apiaries in northern Maryland and also in Pennsylvania, where it seems not to be causing much if any loss.

#### BEEKEEPING REGIONS IN THE UNITED STATES

Lack of funds has prevented active work on this subject, although there is great need for more specific recommendations for beekeeping practice in the varying beekeeping regions of the country. A paper has been prepared for publication outside the department on beekeeping in the Northwest. Information is constantly being collected on the methods of beekeeping suitable to various parts of the country, and it is planned in the near future to begin more active work of this kind.

#### DEMONSTRATIONS IN BEEKEEPING

The work on this project has been still further reduced during the past year and at the close of the fiscal year all cooperative work with the various States was discontinued. The demonstration work begun just previous to the entrance of the United States into the World War was greatly expanded during the war. Later the work has gradually been transferred to the several States in which work was done, and it is gratifying that in almost all such States the work has been continued at State expense, indicating that the need for such work is becoming generally recognized.

Under this project the office aims to maintain contact with the beekeepers of the country, and in the absence of field employees it is necessary for the office staff to attend certain of the more important gatherings of beekeepers in various parts

of the country. This serves the purpose not only of letting the beekeepers know what the office is doing in their behalf but also keeps the men of the office in close touch with the needs of the beekeeping industry.

#### MISCELLANEOUS ACTIVITIES

The correspondence of the office, chiefly handled by E. L. Sechrist, continues to be heavy. Although the present low price of honey has discouraged the beekeepers in all parts of the country, they still continue to take a deep interest in their work and to submit their inquiries to this office. The development of beekeeping work in the various States has doubtless decreased the inquiries direct to this office, but there has been no appreciable falling off in the correspondence since the war.

#### INSECT PEST SURVEY

J. A. Hyslop has continued in charge of this branch of the bureau's work since its inception in March, 1921. The survey has now functioned three years and three months and is constantly becoming more intimately associated with the entomological activities throughout the country.

The cooperation of the several States in supplying the survey with data on general and unusual insect conditions is now so well organized that the survey is in a position to report at any time on the entomological situation prevailing in any part of the United States, and by its cooperative agreement with the Dominion of Canada's Insect Pest Survey Service is also closely in touch with the situation throughout that country.

In recognition of the survey's position it has been requested to participate in the meetings of the Crop Estimate Board, to serve that board in an advisory capacity on the status of insect pests affecting the crops upon which this board issues estimates.

During 1923 the survey completed volume 3 of its monthly bulletins in 8 numbers which consisted of 338 pages of text material and an index of 38 pages. Volume 4, Nos. 1 to 4,

was also issued during the last fiscal year, comprising 149 pages of text material.

The special reports on other urgent matters were issued during the year from Nos. 26 to 35 and emergency matter was handled in the form of telegraphic reports. These latter assumed a rather important phase during the current year in keeping the entomological agencies in the Cotton Belt in close touch with the northward movement of the cotton leaf-worm. As the season was unusually late, the presence of this pest was decidedly more significant than in the average year, and favorable comments on this service have been received from several sources.

During the past year the survey occupied a considerable part of the time at the annual meeting of the American Association of Economic Entomologists, held during the Christmas holidays in Cincinnati. This time was devoted to a symposium on "Methods of Estimating Insect Abundance and Damage." Many constructive papers were presented and the meeting resulted in the appointment by the association of a committee to prepare a report for the next meeting, recommending to the association a system of codifying methods of estimating insect abundance and damage.

The preparation of the index of common names applied to insects in this country, which the survey prepared for the association, resulted in the appointment of three members of the bureau to act as part of the association's permanent committee on common names. The committee presented at the Cincinnati meeting a very comprehensive list, which, after certain revisions, will be published during the coming year and should materially facilitate the use of uniform common names in this country.

The survey now has in manuscript form a technical paper on the correlation of climatic conditions with the abundance of the chinch bug throughout that part of the United States where this pest was a serious factor from the years 1870 to 1920, inclusive. This paper should be completed during the coming year.







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## REPORT OF THE CHIEF OF THE OFFICE OF EXPERIMENT STATIONS

UNITED STATES DEPARTMENT OF AGRICULTURE,  
OFFICE OF EXPERIMENT STATIONS,  
*Washington, D. C., September 10, 1924.*

SIR: I have the honor to submit herewith the report of the Office of Experiment Stations for the fiscal year ended June 30, 1924.

E. W. ALLEN, *Chief.*

HON. HENRY C. WALLACE,  
*Secretary of Agriculture.*

### CHANGE OF STATUS OF THE OFFICE

On July 1, 1923, the Office of Experiment Stations entered upon a new stage in its history. It was segregated from the States Relations Service on the dissolution of that bureau, of which it had been a division since 1915. Previous to that time it had had assigned to it various other functions than those pertaining to the relations with the experiment stations, which gave it a more complex organization.

As now organized the office is charged with representing the Secretary of Agriculture in his relations with the State agricultural experiment stations under the acts of March 2, 1887, and March 16, 1906, and with the direct management of experiment stations maintained by congressional appropriation in Alaska and the insular possessions. Its chief activities during the year have related to the maintenance of these relations and the preparation for publication of Experiment Station Record. The latter, in addition to presenting reviews of the current literature relating to agriculture throughout the world, is one of the sources of contact between the office and the experiment stations in relation to their policies, methods, and progress.

The funds with which the office had administrative and supervisory relations amounted to \$1,743,600. Of this amount, \$98,600 was for the maintenance of the office, \$1,440,000 for the assistance of the State agricultural experiment stations under the Hatch

and Adams Acts, and \$205,000 for the support of experiment stations in Alaska, Hawaii, Porto Rico, Guam, and Virgin Islands.

The funds assigned for the maintenance of the office under the reorganization were based on estimates of its requirements, difficult to determine in advance because of the fact that previously it had not had a definite appropriation or assignment to cover its entire expenses but had shared in general appropriations and facilities of the States Relations Service and had been relieved of many overhead expenses provided for in that organization. The year, therefore, was an experiment in the adaptation of the above means to designated ends. The experience has shown that the assumption of the various charges essential to operation, some of which could not have been definitely anticipated until the reorganization had been tried out, has left little leeway and has required the most rigid economy in order to carry out the primary duties with which the office is charged. Stated expenses have left little for replacements or contingencies, and supplies on hand at the beginning of the year have had to suffice very largely. It has been impossible to meet certain calls upon the office or to afford relief from regular duties to take up special studies, and undertakings which it has been hoped to enter upon have had to be deferred. These relate particularly to bibliographic aids and reviews which the office has been urged to prepare and which are important in promoting the

research of the stations and agricultural extension. A beginning, however, was made in this direction.

### RELATIONS WITH THE STATIONS

As in the past, intimate relations with the stations have been maintained throughout the year, including a visit to each station by a representative of the office and extensive correspondence. In addition, many new research projects have been submitted to the office for comment and approval, the programs for work and expenditures of the individual stations have been passed upon, and part has been taken in the activities of the Association of Land-Grant Colleges at its meetings and through committees.

The oversight exercised in relation to the Federal funds of the stations has pertained not only to the actual expenditures but quite as much to the maintenance of conditions under which the moneys could be advantageously used, the provision of suitable personnel, and the maintenance of an adequate grade of research effort. The effort has been to stimulate and encourage investigation of fundamental character along original or progressive lines, as called for by the present state of knowledge and the present character of problems, having due regard to the application of the findings in practice. The importance has been urged of making the investigations and experiments constantly progressive in their character, advancing from step to step on the basis of the results obtained and the broadened insight which their interpretation has permitted; and to that end there has been advocated the revision of projects from time to time, the taking account of stock to determine their progress and their promise, and the gradual termination of those which have served their purpose or, if not concluded, have reached a point where they are not making progress. By such sympathetic criticism it has been sought to make the work increasingly efficient and effective and thus represent the most advantageous use of the available funds.

The extent to which the Federal and State funds are intermingled in the support of station projects has resulted in this review comprehending practically all the station work, irrespective of its support, and this has been encouraged by the station authorities. Many projects have purposely been placed in part upon Federal funds, especially those derived

under the Adams Act, to insure their critical examination at the time of their inauguration and at stated stages during their progress. The supervision exercised, while designed primarily to conserve the Federal funds, has also resulted in the maintenance of standards and the development of policies which have applied to the work under all funds. The influence and stabilizing effect of the Federal appropriations have, therefore, been quite out of proportion to their size. Insistence upon a conservative policy of continuity in work has guarded against frequent shifting to meet temporary demands, and the encouragement of a critical review of projects as to their progress has tended to avoid marking time.

There has been much interest in developing more formal experimentation and research in the field of agricultural engineering. This has been encouraged by the relations of the office to the American Society of Agricultural Engineers through one of its specialists who is an active worker in the society. Reviews of the progress of research in that field have been presented, with discussions of the essentials of research, the organization of projects, the procedure necessary to attain desired ends, and similar matters. Outlines of projects in considerable numbers have been voluntarily submitted for criticism and suggestion, with many assurances of the aid which was being rendered. In a number of States steps have already been taken to give more systematic attention to inquiry in this field, where the opportunity is felt to be large, but men especially trained for research are as yet relatively few.

### PROGRESS OF THE STATIONS

The present volume of the experiment station enterprise is indicated by the amount of funds available for its use. This, however, is difficult to determine accurately because of frequent lack of clear differentiation between the station support and that of other branches of the college, the maintenance of farms and other commercial enterprises, and the assignment of duties to the station, such as those of regulatory and public service nature, which lie outside the function of the station as a research institution. Special effort has been made by the office to secure more reliable and informing statistics on this point, which will show not only the total funds available to the stations but



the extent to which these are being used for research, for the maintenance of branch stations, for the conduct of farms, regulatory duties, etc.

At the present time the various resources of the State stations amount to upward of \$9,000,000, including the Federal fund of \$1,440,000. The latter, therefore, comprises only a relatively small proportion of the whole, but because of its regularity and of the standards it carries it is a large factor in the conduct of the stations.

Few of the State legislatures met during the year, so that there was little opportunity to provide additional support for research. However, this was done in several cases, and although the added amounts were not large there appeared to be a general feeling of appreciation of these institutions and a desire to give them more substantial aid as opportunity offered. This attitude was evidenced by the fact that in a number of States the stations or branches of them were the only institutions to receive increases.

There has been a renewed movement on the part of several States to provide substations to deal with the special problems of sections presenting conditions which need to be taken account of. In Kentucky and Texas, for example, two such branch stations in each State have lately been provided for under the management of the central station. Some of the States are so large and represent such varied conditions for agriculture that substations are essential. The new additions in Texas bring the number in that State up to 14.

The general agricultural situation and the development of agricultural extension work have placed new and increasing demands upon the experiment stations for reliable advice and assistance, which can only be provided through research. In the attempt to meet the demands upon them these institutions are carrying a total of more than 5,000 separate projects. This number is in excess of the number of lines of investigation which can be adequately prosecuted with the forces and the maintenance funds now available; and in addition there is urgent demand for more research in the fields of rural economics, home economics, and agricultural engineering. With the present limitations of funds the stations are rarely able to embark on new lines or to expand in lines already under way.

In this connection, the interest shown by various industries in pro-

moting investigations by the stations in special lines is worthy of mention. Industrial fellowships have been established in considerable numbers, the investigations to be carried on under the direction of the experiment station, which is given entire control over the course which the work takes and publication of results. Subsidies have also been placed at the disposal of the stations to aid work in special lines, as, for example, a gift of \$1,000 from an association of paint and oil manufacturers to further work in the growing of wheat and flax in mixtures, a donation of \$2,000 from a milling company for a cereal-breeding greenhouse to aid in such investigations, funds for advanced research in the use of sulphur and the action of lime, and many others. One State provides that soil surveys may be conducted for private landowners at the latter's expense, and under this arrangement work was undertaken for a large bank in surveying over 40,000 acres of wild land preparatory to its development.

The stations are also being called upon for aid in connection with public works. One station which is carrying on investigations relating to the utilization of sewage has received an assignment of \$1,500 from the sewage commission to aid in its studies in that direction. In another State the legislature has recently provided for a water-power and agricultural survey, and has placed the latter in the hands of the station. In several States provision has been made for a study of the possibilities of farm use of electric power. Instances might be multiplied, but the above are sufficient to show the broader field in which the stations' aid is being sought and the relations to some of the large enterprises of their States which they are naturally assuming.

How disastrous the effect of continued inadequate support may be is instanced by a case the past year in which failure of relief from straitened circumstances has so discouraged the station forces that the director and several of the important members of the staff have accepted offers in other States. The outlook was not such as to give encouragement for the future, and the manner in which the fortunes of the station were bound up with those of the agricultural college, despite the favorable attitude toward the support of research, was an added element.

To a large extent the fortunes of the experiment station are naturally

associated with those of the college. Usually the union is very close, the station standing as a department of the institution, and the effects of the financial condition of the college or the public attitude toward its support are early reflected in the station. The administration of the college teaching in agriculture and the experiment station is united in one officer in half the States, and in other cases the station rarely has a separate budget or items which stand out in the estimates of the college. Hence there is little opportunity for it to present its needs or for making special provision for its relief. The fact that there is less independence of administration and less individuality of the stations than at an earlier period has to some extent complicated the relations of the department with the stations and has called for dealing with the college authorities in various matters.

In fully half the States the stations are in direct charge of the dean of agriculture, with no technical associate to give primary attention to station administration. This usually results in making the station organization less definite and has led to the necessity of stressing the need for more adequate administrative attention to station affairs, with a survey of the field and a study of the adequacy and proper balance of the program to meet the situation.

### STATE REGULATION

The tendency within the States in the direction of more systematic supervision and regulation of State funds has been commented upon in previous reports. As the Federal appropriations are frequently involved, a study has been made of the effect of such control and regulation.

Changes in local fiscal arrangements and systems of accounting are frequently made without relation to the effect upon the Federal funds, these funds constituting relatively so small a proportion of the total that the special requirements pertaining to them are overlooked or are minimized by new fiscal officers. This is especially likely to be the case when these officials are responsible to State agencies which prescribe uniform systems for all State institutions. While the department's requirements have been quite elastic with respect to the accounting methods, certain procedure has been prescribed with reference to them. This involves the keeping of a current account on each of the

Federal funds, supported by appropriate and properly certified vouchers; and places with the director of the station the responsibility for the manner in which the funds are used. The department under the law prescribes the form of classification of expenditures, and the latter has been modified to accord with the classification system applying to all Government expenditures.

It has been necessary in a number of instances to insist on the recognition of these simple requirements, including the approval by the director of all requisitions or vouchers, and this has sometimes had the effect of extending the procedure to State funds as well. Readiness to accede to the department's requirements as applied uniformly to all the States, when the matter was clearly presented, has been a matter of much satisfaction, and in conformity with this spirit the largest practicable latitude in meeting the local requirements has been granted.

There are various forms of State regulation, however, to which the stations have been subjected which impose a peculiar hardship upon them. These regulations are drawn up primarily with reference to charitable, penal, and educational institutions of lower grade, and similar State enterprises. They are made, however, to apply to the State colleges, and often with little elasticity or appreciation of distinctions. Restrictive as they may be to other branches of the college of agriculture, research probably suffers more severely than any other. One form which this control has taken in several States has been the subdividing of appropriations in great detail so as to fix the amounts which way be used for salaries, for labor, for various classes of supplies and apparatus, and even for the support of individual projects. Not alone the total salaries but those of individual workers have been thus stipulated; and in some cases new positions can not be established, vacancies filled, or a salary increased, no matter how great the exigency, without recourse to State officials. Unless requirements are estimated for in advance, the station may not make purchases necessitated by unforeseen contingencies in connection with the progress of its investigations.

Restrictions on travel outside the boundaries of the State are becoming quite common and frequently impose a decided handicap. One of the most serious types of control is that relat-



ing to publications. This affects not only the amount and form of publication but also the subject matter. In numerous instances, in a number of States, manuscripts reporting important results of investigations have been rejected by State supervisory officers, and in other cases have been edited or reduced until they were inadequate. In at least six States provisions of law require the approval of all printing, making possible the control of the form of publication, the illustrations and tabular matter, the details and length of presentation, and practically placing in the hands of such censors the determination of what may and what may not be published by the stations. This will be recognized as one of the most serious forms which State supervision could take, unless it is exercised with the greatest liberality and with large reliance upon the judgment of the administrative officers of the institution.

Where the Federal funds and the work under them are exempt from such State supervision, they afford a measure of freedom in meeting actual requirements, but with the extension of this practice the Federal funds are being involved and subjected to like restrictions. In several States, for example, there is provision that salaries paid from the Federal funds shall not exceed the salary scale fixed by the legislature for State funds, and the legislature in one State during the past year instituted a provision that the salaries allowed from State funds are not to be supplemented by Federal funds. Such limitations impose an added handicap, for the Federal funds of the station have frequently been used to supplement State appropriations for salaries, making it possible to retain a class of workers who would otherwise be lost to the institution. One new law requires the head of each college, hospital, asylum, board, department, or other institution receiving support wholly or in part from the State to file in duplicate a monthly report showing for each employee "the kind of service rendered, number of days present and working, and number of hours actually engaged in work each day," together with any outside service or employment rendered.

In some cases this regulation of expenditures by State officers is becoming so drastic as to threaten improper interference with the Federal funds and their local supervision in accordance with department regulations and to hamper their use for the purposes for which they were appropriated.

These funds are paid in advance in order that the stations may have a working capital to meet necessities as they arise, and they are turned over to the colleges as the agencies authorized by the States to receive them in their original acceptance of the acts. While the States undoubtedly have a responsibility for the use of these funds, and are fully justified in a form of audit which will guard these responsibilities, there would appear to be no warrant for setting up a procedure which will interfere with the free and proper use of these funds under the Federal laws or place the stations at a disadvantage in carrying out their plans for research after the latter have been approved by this department.

### PUBLICATIONS OF THE STATIONS

For a number of years the regular publications of the stations have not increased materially in number or in volume. There are, however, far less of popular or extension character, so that the present volume is to a larger extent based on new station investigations. Moreover, the practice has steadily increased of publishing the more technical results of research in scientific journals. This has followed the belief that the desired audience was better reached through such journals, with less likelihood of misleading or confusing the public. There is no question but that a larger amount of material from the stations is being published, and that it marks a very material advance in fundamental character and originality.

The growing out-of-State demand for the bulletins and reports of the experiment stations has reached unusual bounds, showing the wide interest and application of their findings. This is illustrated by the case of a single station which may be taken as typical. During the calendar year 1923, copies of its publications were mailed in response to individual requests to every State in the Union, in numbers ranging from a few to over 1,100. The requests from within the State (where there was a regular distribution) amounted to about 2,400, compared with over 14,000 from the United States as a whole, and nearly 1,000 additional requests from foreign countries were supplied.

To guard against the waste of publications and to keep down the required editions, a considerable number of stations have abandoned their mailing lists except to libraries and



workers in similar institutions, and send their publications only upon individual request. In such instances forthcoming bulletins are announced through the press and by means of post cards. This plan has served to reduce the cost of printing, but it has imposed another expense which may largely offset it, namely, that of postage on the announcements, since the Post Office Department has ruled that these may not be franked. Some stations having tried the experiment have been disappointed with the results and have felt that they were not reaching the farmers as they should. They have, therefore, returned to the plan of maintaining regular mailing lists corrected at frequent intervals, and in many cases classified according to the lines of interest of the individuals. Others have used the extension forces as a means of calling attention to new issues.

The publication charge is an increasing one, and has become a more serious burden with the increased cost of paper and printing and the straitened financial circumstances of most of the stations. The office has urged the prompt publication of the results of investigation in order that they might be available to the public. In advising the issuing of the more technical matter in journals and in research bulletins, it has stressed the importance of not overlooking the general public and its right to the products of station work as rapidly as they had been reduced to practical applications. The popularization of the investigations of the experiment stations is a matter of great importance and is receiving increasingly more general attention.

Naturally the cooperation of the extension service is relied upon quite extensively in giving publicity to the work of the stations, and especially in assisting in the introduction of its findings in practice after their applicability has been demonstrated. This calls for close relationship and association between the workers of the two branches. It implies not only a helpful attitude but a feeling of mutual dependence, and it has frequently involved some affirmative action on the part of both branches in maintaining these contacts.

Considerable attention has been given to this matter in connection with the annual visitation of the stations, and it is gratifying to report that notable progress has been made in the direction of working in close union, to the mutual advantage of both

branches of the work. Occasional instances of the opposite nature, which stand more or less as exceptions to the rule, are due in part to the system of organization and to an evident failure to appreciate the importance of this matter. Where difficulties exist, the office is using its influence to detect them and to remedy the situation.

### CHANGES IN LEADERSHIP

The year marked a change in the directorship of the stations in 5 States. This is not an unusual number, since during the past three years the administration of the stations in 15 States has changed. In each of 2 States there have been two changes in that short time.

In only two cases during the past year has more definite provision been made for the administration of the experiment stations, but, on the contrary, in at least 3 States there has been a combination of the previously separate directorship of the station with the office of dean or director of extension. The union of the two stations in New York, by which the State station, established in 1882, was brought under the trustees of Cornell University and both stations placed under a single director, was a notable step in coordination.

Frequent changes in management tend to interrupt the continuity of the administration and sometimes modify the policy in details. Usually they call for added attention on the part of the department. They emphasize the importance and the value of a fairly definite plan and program for the experiment station, so as to give as large a measure as possible of permanence and continuity to its efforts when administrative changes become necessary.

### DIVISION OF INSULAR STATIONS

The agricultural experiment stations maintained by this department in Alaska, Hawaii, Porto Rico, Guam, and the Virgin Islands, under the supervision of Walter H. Evans, chief, have continued their efforts to develop a type of agriculture suited to Alaska, to restore it to its former importance in Guam, and to diversify it in Hawaii, Porto Rico, and the Virgin Islands so that new industries may be developed and opportunities offered to those not so situated as to permit their engaging in the leading agricultural industries of those islands. The stations have never sought to antagonize

any established industry but their policy has always been to supplement them.

In Alaska, agriculture must be developed to supply the growing needs of the country, and with varied conditions as to soils, climate, and length of season it is necessary to conduct investigations along many lines to determine what is best suited to the different regions. A large amount of adaptation work, which is beginning to show results, has been undertaken. Selections and hybrid grains developed by the stations have shown their superiority over introduced varieties even in an exceedingly favorable season.

In Hawaii, the banana industry is beginning to show the influence of the station's investigations, and the extensive growing of pigeon peas, an introduction of the station, is greatly adding to the forage resources of the islands, as well as improving the fertility of the soils.

The work begun by the Porto Rico station for the elimination of the cattle tick has been widely extended, and there are now more than 200 dipping vats in use in the island. Many plantations have been freed of ticks and improvement of the cattle is rapidly taking place. Dairying is becoming an important industry of the island.

The work of the Guam station is suffering from a lack of adequate support. Much time and effort were expended during the past year in repairing damage done to the station property by a typhoon and in attempts to check the spread of the coconut scale, which threatens the leading industry of the island.

The Virgin Islands station, though operating for several years under a deficient rainfall, has shown the possibility of growing vegetables in considerable variety and quantity if attention is paid to favorable times of planting and proper methods of cultivation. Larger supplies of vegetables of better quality are now to be found in the markets, and numerous individuals are beginning to cultivate gardens.

All of the stations are in need of larger appropriations to adequately carry on their work. Their only income is derived from appropriations made by Congress. The income of the stations for 1924 was: Alaska, 5 stations, \$70,000; Hawaii, including extension work, \$50,000; Porto Rico, \$50,000; Guam, \$15,000; and the Virgin Islands, \$20,000. Since 1920 the total appropriations made for the in-

sular stations have suffered a reduction of about 5 per cent. During the same period the total incomes of the agricultural experiment stations on the mainland have been increased by about 25 per cent. The reduced income of the insular stations has been a serious handicap to the development of their work, and it becomes particularly serious when it is understood that from the appropriations all building and repairs must be paid for, while most of the mainland stations have special funds for these purposes, or they are supplied by the institutions with which they are affiliated.

The projects of all the stations have been reviewed and a number have been suspended or modified so as to admit of more concentrated effort along fewer lines. While the stations, by reason of their situations, are forced to carry on work that appears to be elementary in some respects, they are all trying to study fundamental principles of agriculture as modified by local conditions, and a considerable number of their contributions have appeared in technical and scientific journals.

#### ALASKA STATIONS

The visit of President Harding and party to the Fairbanks and Sitka stations in July, 1923, was one of the outstanding events of the year. The aims and work of the stations were explained to the visitors, and some opportunity was given for them to see the application of the results in various localities. So favorably impressed was the President that he suggested more liberal aid for the development of the scientific, technical, and demonstration work carried on in the Territory.

The season of 1923 was very favorable for crop production in the interior of Alaska, the mean temperature having been a little higher than the average. At the Fairbanks station the frost-free period was 135 days, and at the Matanuska station it was 128 days. This permitted the ripening of all the varieties of grains that have been developed by the stations, as well as many others that were being tested. There was a deficient rainfall that resulted in short straw but did not seriously affect the yield of grain. Coming after the disastrous season of 1922, when early frosts destroyed most of the grain, the favorable season enabled the stations to increase the seed stocks of many of the varie-



ties that were all but lost and to be again in position to aid settlers to secure varieties that are known to be adapted to the region. To make up for the lack of locally produced seed grain, the farmers of the Tanana and Matanuska Valleys sent to South Dakota and elsewhere for seed of early maturing varieties. These were also tested at the Fairbanks and Matanuska stations. Of about 30 varieties of wheat so tested none proved equal to Siberian No. 1, a variety developed by the stations. Some proved promising and these have been retained for further trial, but most of them required so long a season to mature that they can not be recommended for general planting. Similar results were obtained with barley and oats, the stations' selections and hybrids proving the earliest in maturing and giving the heaviest yields.

For a number of years the interior stations have given much attention to leguminous crops for forage and green manure. Some varieties of Siberian alfalfa and hybrids between these and other varieties have proved hardy, but seed production is not abundant and their spread is rather slow. Work was taken up with some annual legumes, and at the Rampart station there was developed a strain of the garden pea, known as the Alaska, that has ripened its seed every season at that station. This strain was given a trial at the Fairbanks and Matanuska stations and it is now well established in the valleys contiguous to the stations, settlers growing the crop to pasture off with hogs, or peas with oats for hay and silage. The success with this strain of the Alaska pea has led to inquiries concerning it from regions remote from Alaska. The variety is prominent among those used for canning purposes, and in 1924 a prominent seed grower made a small test of the station strain to compare its earliness, quality, and adaptability to lower latitudes. The results were so promising that a large canners' association has requested sufficient seed from the crop of 1924 to make field trials in 1925 in several localities in the States.

In 1923 there was begun the first attempt at an agricultural survey of the Territory. M. D. Snodgrass, who had been connected with the Kodiak and Fairbanks stations for about 16 years, was assigned to this work. During the season he visited 281 homesteads in the Tanana and Matanuska Valleys and adjacent regions. These homesteads embrace 59,320 acres,

of which 4,351 acres were in cultivation or cleared meadows. He found 1,513 acres in cereals that yielded 1,656 bushels of wheat, 2,479 bushels of oats, 1,959 bushels of barley, and 970 tons of grain hay. Twenty-five acres were in peas that gave 192 bushels of seed and 24 tons of pea hay. Potatoes were produced to the extent of 23,000 bushels, and 312 tons of other root crops were reported. Besides the main crops nearly every homestead was found to have a vegetable garden. On the same homesteads 1,528 head of livestock and 6,584 of poultry were maintained. In connection with this survey cooperative demonstration work was taken up with some of the more progressive farmers in every community.

Considering the limited number of animals available for experimental purposes, the livestock work is progressing as satisfactorily as can be expected. The crossbreeding of Galloway and Holstein cattle to secure a more hardy milk cow is being continued, and at the close of the year 1923 there were at the Kodiak station seven crossbred cows, four yearling heifers, and five heifer calves. The Galloway characters of color and absence of horns are dominant, while in length of body the crossbred animals resemble the Holsteins. The yield of milk of the cows that have freshened seems intermediate between that of the two breeds. In September, 1923, the Fairbanks station secured from the Canadian Government two female yak and a bull calf to add to the stock used in an experiment to secure a hardy beef animal by crossing the yak with Galloway cattle. Crossbreeding yak with domestic cattle is extensively followed in Mongolia, where the hybrids bring much higher prices than either of the parent stocks, and the Canadian Government has taken up the experiment along the same lines as those adopted at the Fairbanks station, except that Polled Angus cattle are used instead of Galloways. The first calf in the experiment at Fairbanks, a heifer, was born May 10, 1924.

The Alaska stations are in need of larger resources so that they can establish and equip laboratories for fundamental studies on some of the very interesting problems that have arisen. New buildings are needed at the Fairbanks station to replace temporary log buildings erected in 1907 and added to as funds were available. More cleared land is needed at every station so that the work can be conducted on a larger scale. If the



animal breeding work is to achieve success within a reasonable time more breeding stock should be purchased so that larger numbers of offspring can be secured.

B. L. Schneider, who succeeded F. E. Rader in charge of the Matanuska station in 1922, resigned February 12, 1924, and M. D. Snodgrass was placed in charge of the station. J. C. Wingfield was appointed assistant horticulturist at the Matanuska station May 1, 1924.

The publications issued by the Alaska stations during the year were: Report of the Alaska stations, 1922; Bulletin 4, Production of Improved Hardy Strawberries for Alaska; Bulletin 5, Eradication of Tuberculosis in Cattle at the Kodiak Experiment Station; and a revision of Circular 1, Information for Prospective Settlers in Alaska.

#### HAWAII STATION

The Hawaii station continued its policy of diversified agriculture, fostering in every way within its resources those minor agricultural industries that appear of potential promise. The wisdom of this policy is being locally recognized as it is becoming apparent that, with the great diversity of conditions in the islands and the varied population, other types of production than those relating to such leading specialties as sugar and pineapples are important for the utilization of the resources. Crops are being found for areas not adapted to sugar cane and pineapples, and it is believed that these can be developed in such a way as not to interfere with the major agricultural industries of the Territory. A new steamship line between Honolulu and the Pacific Coast States will, it is believed, aid in developing industries through increased shipping facilities.

Considerable interest has been shown in the station's work with the edible canna, and a starch industry based upon this plant is being built up. The edible canna grows readily in situations not suited to sugar cane or pineapples, can be harvested at almost any time, so that its gathering will not interfere with the major operations of manufacturing those crops, and the starch can be produced and marketed in successful competition with potato and corn starch. The tubers, or corms, can also be utilized as a substitute for potatoes in the human diet, and they have a high feeding value for livestock. A number of problems relating to the extraction

of the starch, storing of tubers, as well as field management, and harvesting are receiving attention.

The fertilizer studies of the banana were continued, and the second crop, which has just been harvested, showed small but consistent increases in the weight of bunches from the fertilized plots. Small applications immediately following irrigation have given better returns than large ones at any stage of the growth of the plant.

The experiment on the supposed deficiency in mineral substances of locally grown vegetables has attracted considerable attention. Preliminary experiments did not show that Hawaiian vegetables were deficient in iron or other mineral constituents when compared with those produced on the mainland. The experiment is being repeated, vegetables from the same lots of seed being grown in Hawaii, on the Arlington Experiment Farm, near Washington, D. C., and at Corvallis, Oreg.

The horticulturist continued his investigations on the cultural requirements, vegetative propagation, and development of new varieties of tropical and subtropical plants. This work is being carried on at the central station, the Tantalus substation, and in cooperation with growers on each of the larger islands. An attempt is being made to develop the banana industry, and four commercial varieties have been studied in the Kona district of Hawaii. The Chinese banana grown on Oahu is the only variety exported, and where it is grown commercially it must be irrigated twice a month. Excellent bearing plants were found of this and other varieties where irrigation is not necessary, and it is believed that an important banana-growing industry can be developed on land not now used for any crop.

Very successful methods have been worked out for the vegetative propagation of some important tropical fruit trees. A form of side grafting for the propagation of mangoes is giving good results. The growing of breadfruit trees in Hawaii is on the decline on account of the difficulty of propagating this seedless tree, but a method of propagating from root cuttings has been worked out that has given as high as 60 per cent root cuttings. A number of cuttings of choice varieties of breadfruit were secured from Samoa and successfully propagated in this manner.

A considerable number of new varieties of fruits and nuts are being tested

and a large amount of seeds and plants was distributed to cooperative growers to determine their adaptability to various local conditions.

The agronomy work has centered very largely on the production of grasses and forage plants for dairy cows, root crops, and green manure crops for maintaining the fertility of the soil. Experiments are in progress with 36 species of forage plants, and the more promising ones are being grown for propagating material and further selection work. Selections have been made of a strain of sorghum from Manchuria that is much more vigorous than the parent plants and also of a heavy seed-producing strain of the pigeon pea. Tests are being made of various kinds of table corn, but none has been found equal to the sweet corn developed by the station. Experiments in breeding new varieties of sweet potatoes have been begun, advantage being taken of the heavy seeding of some mainland varieties introduced by the station in variety tests. A considerable number of seedlings are being grown at this time.

The extension work, which by act of Congress devolves upon the station, is being actively continued. The extension agent for the island of Hawaii has been very active in assisting homesteaders with their problems and in working with boy scouts and various groups of school children. He traveled more than 11,000 miles in connection with his work during the fiscal year. Boys' and girls' clubs have been organized by the leader of that work on the islands of Oahu, Maui, and Hawaii, 582 boys and girls being enrolled during the year. This work is of real value among the many races represented and can not fail ultimately to improve the conditions throughout the islands. A new feature of the boys' and girls' club work was the establishment of vacation clubs for youths that had no regular employment during the period that the schools are not in session. The use of a large tract of land for garden purposes has been granted in the Territorial fair grounds, and preparations have been made for a demonstration of club work in connection with a Territorial fair to be held this fall. Demonstration work is being continued in the homestead area of Haleakala on the island of Maui, and at Glenwood on Hawaii. The latter station, which is confined to dairying and poultry raising, is practically self-supporting. In cooperation with the Parker ranch on Hawaii a compre-

hensive experiment with forage crops has been begun. The land, labor, etc., are furnished by the Parker ranch but the planning and general oversight is done by the station.

The station is in need of additional funds to permit of the employment of another research chemist and to further develop the extension work. Two of the larger islands, Kauai and Molokai, have no direct service, Maui is without an extension agent, and Oahu, the most populous island of the group, depends upon the attention the station staff can give to its extension needs. An extension leader with headquarters at the central station would greatly aid in developing this work.

The publications of the station during the year were: Bulletin 49, The Acid Lime Fruit in Hawaii, and Bulletin 50, The Sweet Potato in Hawaii. Several others were prepared and submitted for publication.

#### PORTO RICO STATION

The work of the Porto Rico station suffered some interruption through changes in personnel, but in general it was able to continue the principal lines of investigation. The demands made upon the station for information regarding various problems continued to increase. These requests were met as far as possible through the distribution of publications and occasional visits when the matter was considered to have a bearing on investigations in progress at the station. Extension work, in which the station was previously quite active, was turned over to the Insular Bureau of Agriculture, which now maintains an agricultural agent in every municipality of the island. The station continued to cooperate with the Bureau of Agriculture through supplying data to the agricultural agents and furnishing them seeds and plants for wide test in the island.

Considerable interest is being manifested in dairying in Porto Rico, and in order to supply information the station added during the year four Guernsey heifers and a bull calf. These will be the foundation for a purebred herd to compare the value of such animals in the Tropics with grade herds built up through the continuous use of purebred sires. The station has a grade herd begun with native cows that averaged a production of 8 pounds of milk a day throughout the year. The half-bred animals now give an average of 11 pounds and the three-quarter cows a little over 14 pounds



of milk per day. Work has been begun on the proper method of handling milk in the Tropics and the value of various kinds of forage and pastures. This experiment may have far-reaching importance in ultimately providing larger milk and other dairy supplies at lower cost than now prevails.

The chemical department continued its studies of soils and the use of fertilizers. In a study of the nitrogen economy of Porto Rico soils where nitrogen, phosphoric acid, and potash were applied to heavy cane soils the results indicated that under the conditions of the experiments nitrogen is the controlling factor in cane production, whether applied as commercial fertilizer or in a green-manure crop. Part of the plats were limed and where this was done nitrogen produced greater gains than where no lime was applied. An experiment on the conversion of raw rock phosphate and of guano from caves in the island through the introduction of sulfifying bacteria is in progress and is already attracting considerable attention.

During the year the horticulturist published the results of an extended study of coffee varieties in Porto Rico. About 15 varieties of coffee from various coffee-producing countries were grown in comparison with the common Porto Rican coffee, which is considered a pure Arabian coffee. Some of the introduced coffees when grown in Porto Rico were found practically indistinguishable from the Porto Rican, while others differed very materially. The characteristics of the different varieties are described and the probable value of each variety for particular purposes is pointed out. The work with fertilizers for coffee, especially on the forms of nitrogen to use, progressed satisfactorily, as did that of the application of fertilizers, particularly common salt, to coconuts.

Plant breeding with beans was continued, and some very prolific white strains of the black bean introduced by the horticulturist from Venezuela have been obtained. Variety tests of sweet potatoes and yams were continued, and the varieties Key West and Madeira of the sweet potatoes and Purple Ceylon yam again proved their superiority. These varieties have been extensively distributed throughout the island.

Considerable work was carried on during the year on the effect of variation of length of day on the behavior of plants. Although the difference in

length of day is not so great in the Tropics as in Temperate Zones, it was found to markedly influence the growth and fruiting of certain crops. It is believed that data obtained in these experiments will indicate the most advantageous times for planting certain crops so as to bring them into market when prices are most favorable.

The entomologist demonstrated the practicability of fumigating tobacco warehouses and factories for the control of the cigarette beetle. Liquid hydrocyanic acid was successfully used in fumigating warehouses, and it was efficient in destroying the beetles in baled tobacco as well as in manufactured cigars. As a result of this experiment the entomologist has been permanently employed by a large tobacco company to continue this control work.

The plant pathologist devoted considerable of his time to a study of coconut bud rot in Porto Rico. It had long been thought that Porto Rico was relatively free from destructive diseases of the coconut, but about 700 diseased trees have been found along the west coast of the island. Trees of all ages are subject to attack, especially those in sheltered situations. From diseased trees a species of *Phytophthora* has been isolated, grown in pure cultures, and successfully used to inoculate sound trees. The disease appeared on the inoculated trees within three months. All infected palms are being cut down and burned in an effort to control the disease. A study is also in progress on a root disease of vanilla which seriously threatens the extension of vanilla planting in Porto Rico. Following the station's work in introducing vanilla growing into Porto Rico several plantations were started, and from one the owner sold this year from 6 acres vanilla to the value of \$13,750. The disease apparently is due to a species of *Fusarium* which seems to be present in the soil. Various methods of control are being investigated, among them soil sterilization and liming.

Attention is being given to some of the pineapple problems of the island. Extended studies have been made of the fertilizer requirements of the pineapple plant and also of the effect of the crop on the soil, in an attempt to learn the reason why a period of rest after cropping soil to pineapples is beneficial. The factors which influence the production of pineapple suckers or slips are also being investigated in the hope that it may no



longer be necessary to import slips from other countries at an added expense with the additional liability of introducing some new disease or insect pest. Commendable progress in all these lines of investigation is reported.

The Porto Rico station is in need of a research chemist and an animal husbandman to fill out the staff. It has the equipment needed and its economical use would seem to warrant the additional members.

During the past year W. V. Tower, entomologist, resigned to go with a large tobacco company; Thomas Bregger, plant breeder, resigned to go to Argentina, where he is engaged in corn-breeding work for the Argentine Government; and W. P. Snyder, assistant plant breeder, left the station service to take graduate study at the University of California. R. L. Davis was appointed plant breeder February 20, 1924. Just after the close of the fiscal year G. Dikmans was appointed parasitologist of the station.

The publications of the station issued during the year were: Report of the Porto Rico station for 1922, a Spanish edition of Bulletin 29, Las Vaquerias en Puerto Rico, and Bulletin 30, Coffee Varieties in Porto Rico.

#### GUAM STATION

The most important event in connection with the Guam station in the past year was the discovery of the coconut scale (*Aspidiotus destructor*) in a number of places in the island. This pest was known to occur on the island of Saipan, about 120 miles to the north of Guam, but its presence in Guam was not discovered until late in December, 1923, when it had become a menace to the principal agricultural industry of the island. The coconut is one of the most important crops of the island, furnishing, as it does, food for men and animals, and as copra it is the leading money crop of Guam. In addition to the coconut, the pest also attacks the breadfruit, avocado, and other important economic fruit trees. As soon as the presence of this destructive pest was recognized an active campaign was begun for its control. A large amount of time of the station staff was given to the organization and direction of control measures, and in this there was the heartiest cooperation of the insular authorities and local people. The methods adopted were the cutting and burning of infested leaves and all undergrowth, supplemented with spraying

the pruned trees with oil emulsion. Trees so treated have shown no permanent injury due to the cutting and spraying, after an interval of four months, and only rarely are any specimens of scales to be found on the new growth. While the spread of the pest was checked, there remains much to be done to bring it under control. Neither the island government nor the station had funds to continue the work as intended, which was to supplement the clean-up campaign by the introduction of parasites of the scale, and a special emergency appropriation was requested of Congress, but it was lost with the failure of the last deficiency bill to become a law. There are several known parasites of the coconut scale, and it is planned to introduce them in quantity as soon as funds are available.

The experimental work of the station was kept up as well as possible with the limited staff and the distraction due to the coconut-scale work.

Continued feeding experiments with copra meal have proved it to be a satisfactory substitute for part of the more expensive grain ration for all classes of livestock. The station has substituted 50 per cent of copra meal in the corn-tankage ration for dry brood sows, and the grade cows have continued to give a good milk flow on a concentrate ration of equal parts of copra meal and ground corn. The horses belonging to the naval government are now being fed a part ration of copra meal instead of all oats as formerly. Copra meal can be obtained at a cost of 1 to 1.5 cents per pound, which makes it by far the cheapest feed obtainable in the local markets.

In a free-choice palatability test of Napier and Guatemala grass and Japanese cane, forage plants introduced by the station, cattle appeared to prefer Guatemala grass and horses the Japanese cane. Cows consumed larger amounts of Guatemala grass than of either of the others, but when each was fed for alternate periods during a lactation period no difference in milk yield was observed. While somewhat less palatable, Napier grass surpasses both Guatemala grass and Japanese cane in yield and resistance to drought, and also has a wider range of soil adaptability. On this account every rancher is advised to plant some Napier grass for emergency use if for nothing else. Paspalum as a pasture grass again showed its superiority over native grasses, fields of Paspalum remaining green during a

rather prolonged drought while all native grasses were dry and brown.

The breeding work with poultry was continued. In the attempt to produce a new breed of chickens by crossing the Rhode Island Red with a native strain the pullets thus far have not equaled the egg production of some of the native hens, but there has been a marked increase in the size of eggs and fowls. Cantonese fowls introduced from the Philippines have shown early maturity, pullets hatched in December, 1923, having begun laying at the age of 134 days. The station continues to dispose of its surplus stock for breeding purposes, and more than 300 chicks are reported hatched from eggs secured from the station.

The agronomy and horticultural work was considerably reduced owing to the inability of the station to provide a trained man to direct this work. The agronomy investigations continued to include tests of introduced forage crops; fertilizer, rotation, and culture experiments; the management of new soils; and variety tests of sweet potatoes, yams, and taro.

A considerable number of new forage plants have been introduced, and data are being secured on their relative yields of green forage and number of cuttings. A test of adlay, a forage and grain crop that is highly commended in the Philippines, was begun, and two crops of nine varieties have been grown to determine their productivity. Of a considerable number of varieties tested in cover-crop experiments pigeon peas and velvet beans proved the most efficient and economical cover crops. In the vegetable tests introduced varieties of sweet potatoes and taro have given higher yields than any of the native varieties. With sweet potatoes the native practice of constantly using stem cuttings for planting is believed to be responsible for the apparent degeneration of the stock. A large amount of sweet-potato propagating material grown from imported varieties was distributed, and good reports of them were received from all sections of the island.

The extension work begun so auspiciously in 1919, especially the boys' and girls' clubs, was terminated in October, 1923, and the station is now cooperating with the school department in school gardens. It is impossible to carry on this work without more funds and trained assistants.

The repairs to the station property, made possible by transfers of funds and a deficiency appropriation, were

completed, and the station property is again in a more satisfactory condition.

The Guam station is in need of larger appropriations in order that it may function in a proper manner. Its scientific staff is inadequate and its equipment is below that required for even ordinarily efficient work. It is quite possible that had the station had on its staff an entomologist and plant pathologist, as has been repeatedly recommended since 1917, the situation regarding the coconut scale would not have become so serious. An agronomist and an entomologist should be added to the staff at the earliest possible date.

#### VIRGIN ISLANDS STATION

There was some increase in the precipitation at the station during the past fiscal year, although the total rainfall was about 12 inches less than the 60-year average. As a result crop conditions were much more favorable than those reported last year. Comparatively heavy rains fell in September and October, 1923, and these stimulated planting throughout the island of St. Croix, so that the cane prospects were considered more favorable than they had been since 1920.

The station is wholly dependent on rains for its water supply for crops, animals, and personnel. Two new cisterns with a capacity of 87,500 gallons were constructed and connected with a galvanized-iron catchment area and the old system of cisterns. Additional eaves troughs were placed on buildings not formerly so equipped. The present capacity for storing water is about 155,000 gallons. It is expected that additional water-collecting areas and cisterns will be provided in the near future, thus obviating losses of plants in the breeding work and the expense of hauling water for the livestock. Pipes have been laid to the buildings on the lower part of the station and a measure of fire protection secured. Other improvements made during the year were an implement shed and a poultry house.

The work with livestock was mainly a continuation of milk records of a herd of native cows to get data preliminary to an experiment in breeding up a dairy herd. A purebred Milking Shorthorn bull calf purchased from Cornell University and a fifteen-sixteenths grade Guernsey bull calf transferred from the Porto Rico station were added to the station herd. The grade Holstein bull, purchased in St.



Kitts about 1920, sired seven calves in the station herd during the year.

An attempt was begun toward the end of the year to get some data on the size and egg production of the so-called native fowls. A flock of 50 pullets was secured from various sources and after a 100-day laying test they were weighed separately. The range in weight was from 1 pound 14 ounces to 4 pounds 1 ounce, with an average of 2 pounds 13 ounces. During the egg-laying test, 1,132 eggs were produced, the highest record for any hen being 56 eggs, which was made by a hen weighing but 2 pounds 2 ounces. Her eggs weighed 19.5 ounces per dozen, 1.9 ounces heavier than the average of the flock. This is believed to be the first record made of the performance of native fowls in the Virgin Islands. Breeding experiments with poultry are to be taken up at once.

The principal features of the agronomy work were plant breeding and variety testing.

A comprehensive experiment in testing varieties of sugar cane was begun, and in order that there shall be no introduction of pests into St. Croix, where the only commercial production of sugar is found, a cane quarantine station was established on St. Thomas. About 60 varieties were received from various countries, and they were growing at the end of the year. Any showing especial merit will be taken to St. Croix for further trial after the quarantine period is passed.

No cotton had been grown in St. Croix since 1921 on account of unfavorable markets for Sea Island cotton and the presence of the pink bollworm. In 1923 about 200 acres were planted with seed obtained from Barbados. The plantings were made late in the season, and heavy rains, the "Hardback" beetle, and the pink bollworm practically destroyed the crop. It is evident that there must be a better cleaning of the old fields if cotton growing under pink-bollworm conditions is to be made a success.

A plat of Hairy Peruvian alfalfa was grown in comparison with ordinary alfalfa, and its superiority was plainly indicated.

Crosses were made between native yellow and Black Mexican corn to obtain a suitable table corn, and the progeny is being given a test.

The station is giving considerable attention to improving the sweet potato and increasing its yield, as this

is one of the important food crops that is locally produced in quantity. More than 250 sweet-potato seedlings have been under observation for three seasons, and those that appeared to possess merit have been grown in comparison with the parent varieties. About 45 of them yielded more than the original varieties and some are of superior quality. These are being retained for further test, the undesirable ones having been eliminated. Some of the new varieties are being tested at the Arlington Experimental Farm in cooperation with the Bureau of Plant Industry of this department, and they are considered very promising. An experiment in spacing sweet potato plants in 4-foot rows has shown that the highest yields were obtained when the plants were spaced 12 inches apart in the rows and there was a greater proportion of desirable sizes of roots. Wider spacing reduced the total yield but increased the proportion of oversized roots. Planting sweet potatoes on plats to which stable manure had been applied one year before resulted in too great a growth of vines and reduced yield of roots.

The experiments with vegetables were continued along lines previously reported. It has been found that most of the vegetables of the Temperate Zone can be successfully grown if proper attention be given to suitable seasons for planting, but there is wide variation in the behavior of varieties, and the station is continuing its tests to determine those best adapted to local conditions. Bermuda onions and watermelons were successfully grown in the early winter and a shipping trial of them is contemplated during the next winter. Some of the fungus diseases and insect pests that have been so troublesome in gardens were successfully controlled during the past season.

The orchard plantings were considerably extended. After an extended trial of orchard cover crops the pigeon pea has been found the most satisfactory. It not only is a good soil renovator but its rank growth affords an excellent temporary windbreak for the young trees.

During the year cooperative demonstration work was begun on the island of St. Thomas. Only a small area of land was available and gardening work and fruit growing were begun. As a result of this work many who were formerly engaged in handling freight and coaling steamers are turn-



ing to growing vegetables for local consumption.

During the year M. S. Baker, formerly of the Arkansas Experiment Station, was added to the station staff to carry on the work with sugar cane, corn, and cotton.

The Virgin Islands station is in need of additional funds to enable it to more efficiently carry on demonstration work on St. Thomas and St. John, so that productive industries may be developed for those islands. A commission of the Department of Labor that visited the islands during the last winter strongly urges such work.

The publications issued during the year were: Report for 1922 and Bulletin 4, Truck-crop Insects in the Virgin Islands and Methods of Combating Them.

### PUBLICATIONS OF THE OFFICE

The office published during the year 31 documents, aggregating 2,557 printed pages, besides contributing various notes and short articles for the use of the press service of the department.

### EXPERIMENT STATION RECORD

The preparation of Experiment Station Record was continued without material interruption during the year, bringing to completion volumes 49 and 50, each of which consisted of the usual nine numbers and an index number. In accordance with the general plan of recent years, over 90 per cent of the 1,800 pages available was utilized for the presentation of technical abstracts of the current scientific literature pertaining to agriculture, and the remainder to monthly editorials, discussing questions relating to the promotion of agricultural education and research and brief notes on progress in these directions at home and abroad. The total number of abstracts included was 6,697, a number slightly larger than for the previous year.

On December 1, 1923, the chief of the office retired from the position of editor, which he had occupied since 1899. H. L. Knight, a member of the Record staff since 1906 and associate editor since 1918, was designated editor, beginning with volume 50. This change, however, involved no marked departure in policies. As one of the leading projects carried on by the office, the Record continued to receive the active interest and attention of the chief, including the use of its editorial pages from time to time in the

discussion of matters pertaining to the progress and welfare of agricultural investigation and the American experiment stations.

In response to suggestions from many investigators and others interested in the development of genetics, a section bearing this heading was established with the beginning of volume 50. Under the previous system of classification, articles pertaining to genetics had been necessarily distributed through the sections of agricultural botany, field crops, horticulture, animal production, and dairying, and with occasional items in still other sections. Although the limitations as to space have precluded any material extension in scope, opportunity has been afforded to bring together in the new section the more fundamental studies of variations, cytology as the physical basis of heredity, Mendelism, quantitative and blending inheritance, linkage and crossing-over, sex determination and secondary sex characters, the inheritance of acquired characters, radical crosses, selection and pure lines, breeding methods, and related topics. Material has been supplied by the various members of the staff, contributing jointly along the lines handled by them in the past, but the new policy of segregation gives definite recognition to the growing importance of genetics as a distinctive field of inquiry.

Considerable progress was made in the preparation of two bibliographical aids to the use of the Record, for which many requests have been received. The revision of the list of abbreviated titles, which was found to be a task of unexpected magnitude, was drawing to completion at the close of the year. Copy was also prepared for the eventual issue of a combined general index covering volumes 26 to 40. As no general index has been issued since 1913, the publication of such a volume will be of much assistance in the use of the Record.

### OTHER PUBLICATIONS

A list of bulletins of the experiment stations from their establishment to the close of 1920 was completed and published in a volume of 185 pages. The list includes approximately 12,500 bulletins of the regular series, but does not include circulars or more ephemeral publications. It is planned to issue supplements from time to time (every two years).

The list of workers in the agricultural colleges and experiment stations

was revised and submitted for publication. This list marks a change from previous issues in that the workers are classified according to departments or subjects in which they are specializing. ♦

The classified list of projects carried on by the experiment stations in 1922-23 was issued in mimeographed form early in the year, and data were secured for a revision of the list at an early date. This list includes 5,240 research projects, distributed as follows: Field crops 1,611, horticulture 904, animal production 652, plant pathology 452, entomology 412, soils 310, dairy cattle and dairying 269, veterinary medicine 194, fertilizers 193, rural economics 186, rural engineering 162, and various smaller groups.

A report on work and expenditures of the experiment stations for 1921 was published during the year, and reports for 1922 and 1923 were prepared and submitted for publication. A new feature introduced in these reports was reviews, with detailed bibliographies, of station work on certain special subjects.

The publications of the stations in Alaska and in the insular possessions included three annual reports, seven bulletins, and one circular, as already noted. Several other publications of these stations were prepared and submitted for printing.

### RECOMMENDATIONS

Reference has been made to the importance of enlarging the opportunity for bibliographic work. Such work has been one of the fruitful activities of the office in aiding agricultural research. Productive research is a progressive effort and involves building upon the results of other investigation. The searching out and collection of these results in diverse lines requires much time; hence bibliographic aids are essential tools in the hands of investigators, economizing their time and making their researches more productive.

The office is attempting, without addition to its force, to prepare a combined general index to later volumes of Experiment Station Record, for which there has been urgent request. This is a laborious undertaking and calls for an understanding of the technical subjects covered to prevent confusion in such an index. Under

the present handicap progress is unavoidably slow, and additional help is much needed.

The office has been appealed to by the extension forces to prepare a popular summary of results of experiment-station work for handy reference. Years ago a Handbook of Experiment Station Work was compiled by the office, for which there were many expressions of approval. This has long been out of date, and a volume or series of parts prepared on a somewhat similar plan could be made of great assistance to extension workers and highly useful to farmers. Such an undertaking would require additional help competent to bring together and digest the material.

Attention is called elsewhere in this report to the difficulty of meeting the demands upon the experiment stations in the insular possessions with the appropriations at present available. Usually these stations stand as the only local agency for looking after the welfare of agriculture and advancing its interests. Pioneer conditions are being dealt with, and the opportunity and the need are very real. The serious outbreak of the coconut scale in the island of Guam, endangering practically all of the commercial and food crops of the island, illustrates the inability to combat such outbreaks or meet emergencies with the present limited appropriations.

The office has attempted to determine the general policy and exercise supervision over these insular stations acting at long range. The importance of maintaining closer contacts with them has not been overlooked, but insufficient funds have been available for visiting them except at long intervals. Periods of 8 or 10 years and even more have elapsed between the sending of a representative to examine the conditions and the progress of these stations and the manner in which they were fulfilling their mission. It is felt to be of great importance to efficient administration and the intelligent support of the officers in local charge that provision be made for the means and the personnel which will enable more frequent examination on the grounds. This should prove no less advantageous than the close contact which is maintained with the experiment stations in the States.







## REPORT OF THE DIRECTOR OF THE EXTENSION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE,  
EXTENSION SERVICE,  
*Washington, D. C., September 23, 1924.*

SIR: I have the honor to present herewith the report of the Extension Service for the fiscal year ended June 30, 1924.

C. W. WARBURTON,  
*Director.*

Hon. HENRY C. WALLACE,  
*Secretary of Agriculture.*

### ESTABLISHMENT OF THE EXTENSION SERVICE

On July 1, 1923, the Extension Service of the department was established under the supervision of the Director of Extension Work. The Extension Service is made up of the Office of Cooperative Extension Work, formerly a part of the States Relations Service, the Office of Exhibits, formerly an independent unit in the Office of the Secretary, and the Office of Motion Pictures, previously a part of the Division of Publications. The then Assistant Secretary, C. W. Pugsley, was designated as Acting Director of Extension Work until a permanent appointment to this position was made. Mr. Pugsley resigned as Assistant Secretary September 14, 1923, and on September 24 C. W. Warburton, of the Bureau of Plant Industry, was appointed Director of Extension Work. The duties of the director as set forth in the official memorandum are to direct and supervise all extension activities of the department and to advise with the Secretary and other department officials with regard to (1) formulation and establishment of plans and policies affecting extension work; (2) coordination of extension activities in the bureaus and offices of the department and arrangement of cooperation with other departments or branches of the Government, State agencies, etc.; (3) review and approval of issuance or publication of

statements, orders, circulars, and bulletins concerning extension activities; and (4) matters affecting the personnel engaged in extension work.

### DUTIES AND ORGANIZATION

The Extension Service represents the Secretary of Agriculture in his relations to all extension work conducted by the State colleges of agriculture under the terms of the Smith-Lever Act, and is the agency through which the various bureaus of the department conduct their extension activities. The cooperation between the State colleges of agriculture and the Department of Agriculture in carrying out the terms of the Smith-Lever Act is accomplished through the Office of Cooperative Extension Work. The presentation of information in exhibit form at fairs, expositions, and meetings of all kinds is in the hands of the Office of Exhibits, while the production and distribution of motion pictures illustrative of all lines of the department's activities are centered in the Office of Motion Pictures.

### PERSONNEL

The personnel of the Extension Service in Washington on June 30, 1923, consisted of 162 persons, of whom 112 were employed in the Office of Cooperative Extension Work, 29 in the Office of Exhibits, and 21 in the Office of Motion Pictures. The field force of the Extension Service on the same

date consisted of 3,762 persons, practically all of whom were employed in cooperation with the State colleges of agriculture in conducting extension work in the counties or in developing and supervising this work. In addition, about 1,000 persons not under appointment from the department are employed in extension work in the States.

#### FUNDS ADMINISTERED

The direct Federal appropriation for the Extension Service during the fiscal year was \$1,568,730, of which \$1,284,350 was for farmers' cooperative demonstration work, \$189,300 for salaries and administrative expenses, and \$95,080 for exhibits. In addition, Federal appropriations amounting to \$5,880,000 were made available to the States for extension work under the terms of the Smith-Lever and supplementary acts, and \$11,954,464 were appropriated by the States, counties, and other agencies for cooperative extension activities. The total amount available for extension work in the United States during the fiscal year was \$19,403,194.

#### OFFICE OF COOPERATIVE EXTENSION WORK

##### ORGANIZATION AND PERSONNEL

With the abolishment of the States Relations Service and the realignment of extension activities in the Extension Service, some readjustments were necessary in the Office of Cooperative Extension Work. C. B. Smith has continued as chief of the office, J. A. Evans was made assistant chief, and the general supervision of relations with the extension services in the States was placed in the hands of four regional agents. The assignments to the regional subdivisions were as follows: Northeastern States, Miss Florence E. Ward, assisted by H. W. Hochbaum; Southern States, I. O. Schaub, assisted by C. L. Chambers, I. W. Hill, O. B. Martin, and Miss Ola Powell; North Central States, G. E. Farrell, assisted by Miss Grace Frysinger and H. W. Gilbertson; and Western States, W. A. Lloyd, assisted by E. Merritt and Miss Madge J. Reese. T. M. Campbell and J. B. Pierce, field agents in charge of negro extension work, are assigned to the southern division. The leaders of the work in these regions represent the Office of Cooperative Extension Work in dealing with the State extension directors in the determination of State extension programs and

in organizing field agencies to carry out these programs. They also aid the office in the examination of Smith-Lever extension budgets and in the inspection of Smith-Lever accounts.

The Division of Subject Matter Specialists is under the supervision of A. B. Graham. These specialists represent the several bureaus of the department and serve as carriers of subject matter to extension workers in the States. They also study methods of extension activity in their respective fields. The staff of this division consists of Miss Miriam Birdseye, nutrition; C. P. Close, horticulture; G. H. Collingwood, forestry; H. M. Dixon, farm management; O. S. Fisher, agronomy; C. D. Lowe, animal husbandry; F. P. Lund, food preservation; F. C. Meier, plant pathology; and Miss Gertrude L. Warren, club organization. F. P. Lund was on leave of absence during the greater part of the year, and was engaged in the promotion of agricultural extension work in Denmark.

The Reports and Efficiency Studies Division continued under the leadership of M. C. Wilson. This division summarizes the reports of the county agents and prepares digests for the use of subject-matter and other workers. It also conducts studies to determine the efficiency of the various extension methods and agencies. On July 1, 1923, the collection of statistics on farmers' institutes and of information on extension work in foreign countries was added to this division, under the supervision of J. M. Stedman.

On July 1, 1923, that portion of the former States Relations Service dealing with visual instruction became a part of the Office of Cooperative Extension Work. To it was added the editorial work of the office. Reuben Brigham is in charge of the section.

On June 30, 1924, the Office of Cooperative Extension Work in Washington consisted of 10 administrative and supervisory officers, 12 organization field agents, 10 subject-matter field agents, and a clerical staff of approximately 80 people. During the year I. L. Hobson, specialist in boys' and girls' club work, resigned, and C. D. Lowe, extension specialist in animal husbandry, was added to the force.

The entire State field service on June 30, 1924, numbered 4,744 persons. Of this number, 3,427 were permanently located in the counties, 2,174 being in county-agent work, 851 in home-demonstration work, 133 in boys'



and girls' club work, and 269 in extension work with negroes. The county workers were assisted in their work by 696 full-time and 174 part-time subject-matter specialists located at the State agricultural colleges. There were 394 persons employed as supervisors and assistant supervisors, while the administrative officers and their immediate assistants numbered 53. Of the above total, 3,751 were cooperative employees of the Office of Cooperative Extension Work, practically all engaged either in county work, supervision of county work, or farm-management demonstrations.

#### FUNDS

The total funds from all sources available for cooperative extension work during the fiscal year ended June 30, 1924, was approximately \$19,149,450, or practically the same as for the previous year. Of this amount 37.6 per cent, or \$7,194,450, was contributed by the Federal Government, exclusive of the use of penalty envelopes; and 27.8 per cent, or \$5,324,000, was derived from State appropriations to the agricultural colleges and other State agencies. The remaining 34.6 per cent, \$6,631,000, came from county appropriations for extension work and from contributions by local organizations and individuals. More than 94 per cent of all funds used for cooperative extension work in 1924 came from public sources.

Of the Federal funds, \$5,880,000 was made available by the Smith-Lever law and others supplementary thereto, \$1,284,450 from appropriations to the Office of Cooperative Extension Work, and \$30,000 from other appropriations to the Department of Agriculture. Of the total funds, \$11,832,906 (61.8 per cent) was allotted for extension agents in the counties; \$1,317,695 (6.9 per cent) was allotted at the State agricultural colleges for administration; \$2,208,653 (11.5 per cent) for supervision of county extension forces; and \$3,519,518 (18.4 per cent) for the employment of subject-matter specialists to assist the county workers. The remaining 1.41 per cent, or \$270,678, was for use in connection with the activities of the Federal Extension Service located at Washington. A considerable part of the money expended in Washington and at the State agricultural colleges was for penalty envelopes, report forms, circulars, and other supplies largely consumed by the county extension workers.

#### PROGRESS

With the passing of the years and the acquiring of experience and a background, the need has been shown of better organized programs of extension work and of a better understanding among all people and agencies of the States as to what these programs are and how they may all work together toward a common end. The usual plan followed is for the college of agriculture in each of its various departments, upon the suggestion of the extension director, to assemble the facts regarding each major crop and livestock interest, then invite to the college the representatives of various farmers' organizations, rural bankers, business men's associations, etc., to consider in the light of the facts what kind of an extension program is most desirable to meet the agricultural and home needs of the State. The first thing sought is a broad vision of the facts and needs, and a goal to work toward, supplemented by a very concrete program of work for the immediate year. Representatives of the Office of Cooperative Extension Work have been participants in many of the State conferences which have been held, including those in Illinois, Minnesota, Oregon, and Virginia.

At the Regional Extension Conference of the Western States, held at Fort Collins, Colo., during the year, consideration was given to desirable and possible extension activities in range livestock production, dairying, and human nutrition common to the whole western group of States. To this conference of extension workers were brought the results of the research work of both the United States Department of Agriculture and of the State agricultural colleges that were ready for extension. All available facts on the range livestock industry and dairying and human nutrition in the Western States were assembled. Committees then digested this material and based an extension program upon it. The program was then offered for consideration as something for extension forces to work toward in the development of agriculture and home economics in the West. The program thus worked out was published as Department Circular 308.

Thus are the agricultural colleges and this department increasingly seeking to base their cooperative extension program on the facts as they are found and on acquiring a vision of the whole field that shall put extension work on a sound basis in a state-wide

and national way as well as on a sound basis for each community in which it is carried on.

In addition to the western conference two other regional conferences were held during the year. The one held in Birmingham, Ala., in January, 1924, was attended by the State extension directors and the State leaders of farm demonstration, home demonstration, and club work in the 14 Southern States, besides representatives of this department. During February, 1924, an Eastern States conference was held in Springfield, Mass., devoted primarily to the work of extension specialists in farm management and home management. No general conference of extension workers in the North Central States was held.

These regional conferences are a very helpful influence in crystallizing ideas as to effective methods of doing work and rapid spread of better methods from State to State. Those lines of work in which the extension leaders are given opportunity to meet with like representatives from other States and the Federal Department of Agriculture from time to time, as in nutrition, county supervision, etc., are the best organized and accomplishing most.

#### VISUAL INSTRUCTION AND PUBLICATIONS

Following the organization of the Extension Service on July 1, 1923, the Office of Cooperative Extension Work gave definite recognition to the growing interest among field workers in facilities and methods for visual instruction adapted to cooperative extension work, by the organization of the Visual Instruction and Editorial Section of the office. This section, in addition to giving attention to the editorial and illustrative work of the Washington office, was charged with making available to its cooperative field employees material and data from the department relating to visual instruction, publications, radio, photographs, lantern slides, charts, motion pictures, exhibits, and other illustrative material. Through this section service along these lines hitherto given to its field workers by the office during the existence of the States Relations Service was consolidated and continued without interruption.

**Publications.**—The following publications were prepared by the Office of Cooperative Extension Work and printed during the fiscal year: Status and results of home demonstration work in the Northern and Western

States, 1921; Farm management extension—early development and progress in 1922; Extension work in agricultural engineering, 1922; Statistics of cooperative extension work, 1923–24; An extension program in range livestock, dairying, and human nutrition for the Western States; Methods and results of cooperative extension work reported through county agricultural agents, 1922; A system of field and office records for county extension workers (revised).

Extension workers made 7,131 requests for department publications, which were filled in cooperation with the Office of Publications. About 220 pieces of duplicating were done for the office during the year by the Office of Publications and 416 small jobs by the small emergency duplicating unit operated in this section.

**Information Service.**—The section cooperated with the Department Press Service in assembling and preparing 292 articles relating to various phases of extension work for the Official Record and for press release. A beginning was made in the organization of a picture news service relating to national and regional developments in extension work.

**Visual Instruction.**—At the request of State extension divisions, short talks and discussions were given in methods of extension photography and in the preparation and use of illustrative material at conferences of extension workers in Arkansas, Connecticut, Louisiana, Maine, Massachusetts, New Jersey, Oklahoma, Virginia, and West Virginia.

In cooperation with State extension divisions several carefully planned series of field photographs illustrating extension work were obtained for use in publications, information service, and exhibits, and for distribution in lantern-slide form. In the work 12 States were included, as follows: Alabama, Connecticut, Georgia, Maryland, Pennsylvania, Iowa, Ohio, New Jersey, North Carolina, South Carolina, Virginia, and West Virginia.

The photographic reference file, which includes illustrations on a wide variety of agricultural and home economics subjects available for the use of its Washington and field employees and cooperators, at the end of the year comprised 22,149 photographs, 3,441 new illustrations being added during the year.

In cooperation with subject-matter bureaus of the department eight series of lantern slides were prepared for the use of extension workers on the fol-



lowing subjects: Farm sanitation; barberry eradication; important cultivated grasses; stem nematode disease of alfalfa; sweet potato diseases and their control; storage and handling of cotton; village and town planning; and boll-weevil control. The preparation of approximately 40 other series of slides is in progress. During the year 1,256 sets of slides were distributed for the use of extension workers.

More than 36,000 prints, slides, enlargements, charts, posters, and drawings were requested and prepared for use in extension work. Requests for the preparation of illustrative material filled for this section by the Office of Publications included 2,948 negatives, 21,028 prints, 5,576 slides, 219 enlargements, and 1,251 miscellaneous items, inclusive of blue prints. In the section 4,728 lantern slides, 214 enlargements, and 63 posters were colored for extension use; 247 charts, drawings, and designs were also prepared.

In cooperation with the Office of Motion Pictures five extension motion pictures were completed, as follows: "Better Seeds—Better Crops," "The Corn-Belt Derby," "Limestone for Ailing Clover," "Hidden Foes in Seed Potatoes," and "Seeing Washington." The section assembled and prepared for submission to the director of extension work extension suggestions for new motion pictures to be produced by the department including approximately 40 subjects.

In cooperation with the Office of Exhibits, material was prepared for two interstate boys' and girls' club exhibits at Springfield, Mass., and Sioux City, Iowa, and for the exhibit of club work held in connection with the National Boys' and Girls' Club Congress at Chicago.

**Radio.**—A radio questionnaire was sent to extension workers at the request of the Bureau of Agricultural Economics during May, 1924, the results of which have not yet been tabulated. As a result of a similar questionnaire sent out in the spring of 1923 a summary was prepared showing that of 1,200 agents making replies 86 had radio receiving sets and 480 had access to radio receiving sets. Of those having receiving sets or having access to such sets, not more than 80 per cent were able to get satisfactory market and weather reports of the department. From the data obtained in the questionnaire it is estimated that 145,000 farm families were using radio receiving sets in 1923.

## REPORTS AND EFFICIENCY STUDIES

The largest single activity of the Section of Reports and Efficiency Studies has been the tabulating of the annual statistical reports of the 3,400 cooperatively employed county extension agents. While the revised county extension report form somewhat facilitated this task, the necessity for making sectional totals, as well as totals for county agent work (white and colored), home demonstration work (white and colored), and boys' and girls' club work greatly complicated the tabulating. The completed summary of the 1923<sup>1</sup> statistical reports from county extension agents comprises seven large volumes containing more than three thousand 18 by 26 inch tabulation sheets.

As in previous years, a corps of temporary clerks was employed for a three months' period to assist with the handling of the more than 4,000 annual reports of field extension agents. The cost of this temporary force this year has been slightly in excess of \$8,000.

**Index of Narrative Reports.**—The task of reading and indexing the approximately 4,000 narrative reports of State administrative and supervisory officers, State subject-matter specialists, and county extension agents has been handled by this section with little assistance from other sections of the office. An effort has been made to include in the 1923 index only the more outstanding references which give the necessary details of the work described to make the information of value to one interested in studying that particular phase of subject-matter work. While somewhat smaller in size than the 1922 index, the 1923 index of annual reports contains 384 pages of closely typewritten references.

**Briefs.**—In addition to functioning as a central agency for bringing together national information on the activities and accomplishments of cooperative extension work, the Section of Reports and Efficiency Studies has also functioned as a distributing center for disseminating information on methods of organizing and conducting extension work described in the annual reports of field workers. Digest of the information in the 1922 reports have been made at the request of State and county extension workers and of

<sup>1</sup> Reports of State and county extension workers are for the calendar year 1923 rather than the fiscal year ended June 30, 1924. Of necessity, therefore, the figures which follow in this report are for the calendar rather than for the fiscal year.



members of the department staff. Twenty of these digests or briefs have been duplicated for distribution. The following briefs are included in this list:

<i>Title</i>	<i>Mimeograph No.</i>
Egg Marketing-----	1
Drainage-----	2
Fertilizers for Citrus Fruits-----	3
Forestry-----	4
Boll Weevil-----	5
Crop Rotation-----	6
Weeds-----	7
Cooperative Fruit Marketing-----	8
Dairy Manufactures-----	9
Dairy Bull Associations-----	10
Sweet Clover-----	11
Cotton Variety Standardization-----	12
Home Water Supply and Hydroelectric Power Plants-----	13
Poultry Management-----	14
Poultry Flock Certification-----	15
Poultry Diseases-----	16
Poultry Marketing-----	17
Poultry Feeding-----	18
Potato Spray Rings-----	19
Recreational Activities and Pageants-----	20

Besides the briefs duplicated for distribution, 19 other digests of information in 1922 reports have been prepared by this section.

**Farmers' Institutes.**—On July 1, 1923, the work conducted with farmers' institutes and foreign-extension reports was incorporated with this section of the office. Under the immediate direction of J. M. Stedman, information has been collected from the State colleges and the State departments of agriculture relative to farmers' institutes conducted in 1923. A national report on farmers' institutes has been prepared showing the extent of that work in 1923. The plan of organization in the various States, the personnel and funds involved, and similar information are given.

**Foreign Extension Activities.**—Publications relating to extension work in agriculture and home economics in foreign countries have been reviewed under Mr. Stedman's direction and two reports on this work prepared for general distribution. The one for the publications reviewed during the six months ended December 1, 1923, was distributed to the field early in 1924. This circular was later reprinted owing to the demand for it. A similar report for the six months ended June 30, 1924, is ready to be forwarded for duplication.

**Revised Annual Report Form.**—Upon the suggestion of this section the chief of the Office of Cooperative Extension Work invited the Committee on Extension Organization and Policy of the Association of Land Grant Colleges, supplemented by two representative home demonstration leaders, to meet

with the office in revising the annual report form for use by county extension agents in 1924.

The new report form prepared by this group of workers and adapted for use by all county extension agents in the 48 States is a distinct improvement over the report form used in 1923 and has apparently been well received by the State extension leaders. More nearly comparable information on extension work throughout the Nation will be available from the 1924 annual reports than has ever been available in the past.

**Field Studies.**—To supplement the information available from reports and to build up a fund of facts for use as a guide in the future development of extension work the Reports and Efficiency Studies Section is charged with the conduct of special field studies from time to time. A small beginning has been made in the extension investigational field during the past year. Field studies have been conducted in Marshall County, Iowa, and Chenango, Monroe, and Jefferson Counties, N. Y. Plans have been completed for making similar studies in Colorado, Oregon, and California during the fall of 1924. When several thousand records have been obtained from farmers and home makers in representative sections of the country it is expected to issue a printed circular embodying the results of these studies.

In cooperation with Director Bliss, of the Iowa Extension Service, a field study was made of 549 farms in five townships in Marshall County. The purpose of the study was to determine the extent to which farms and homes have been effectively reached by cooperative extension work and the extension means and agencies directly or indirectly responsible for influencing the adoption of improved practices. A report on the Marshall County, Iowa, study has been prepared but has not been distributed to the field pending the completion of similar studies in other sections of the country.

Following the field study in Iowa, plans were completed with Director Burritt, of New York, to make similar studies in three typical counties in that State, obtaining a total of at least 1,000 records. Chenango, Monroe, and Jefferson Counties were selected and the field work was largely done by representatives of the New York State Extension Service under general supervision of a representative from the Office of Cooperative Extension Work. Three hundred and

thirty records were gotten in Che-nango County, 513 in Monroe, and 382 in Jefferson, making a total of 1,225 records for the State, or more than 200 in excess of the goal set.

#### SUBJECT-MATTER SPECIALISTS

The office has employed, in cooperation with other bureaus, 10 subject-matter extension workers whose business has been to act as carriers of information of an extension nature from the subject-matter bureaus of the department to the corresponding departments and extension offices of the agricultural colleges of the States, and as students of the methods employed in extension for the purpose of most effectively reaching the farms and farm homes and getting improved practices adopted. They also act as a clearing house of information in their respective lines and write an annual report summarizing the extension results accomplished during the year in their respective fields for the use of extension administrative officers. In some cases where funds have not been available to employ a subject-matter specialist the bureaus have designated some member of their staff to summarize the extension work in their subject for the year.

For the purpose of supporting the county extension agents in the States by way of giving special technical service when and where needed there were employed by the States on July 1, 1923, 803 full-time and part-time extension specialists. This number was the equivalent of 700 subject-matter specialists employed on a full-time basis, of which 80 were engaged in agronomy, 68 in animal husbandry, 80 in dairying, 69 in poultry, 64 in horticulture, 25 in entomology (including bee culture), 19 in plant pathology, 5 in forestry, 4 in rodent control, 35 in rural engineering, 48 in farm management, 34 in marketing, 7 in rural organization, 8 in veterinary medicine, 51 in general home economics, 37 in clothing and millinery, 38 in foods and nutrition, 20 in home management, and 8 in movable schools and institutes.

Accomplishments in several lines of work may be mentioned as follows:

**Agronomy.**—Seed improvement, the growing of legumes to increase the amount of home-grown forage and thereby lessen the feeding costs, and the development of near-by sources of lime to lessen the cost of transportation either by train or wagon from the source of supply were the chief

agronomy extension problems stressed during the year. Seed improvement has been developed by a plan of seed inspection and certification. The basis of this work was laid largely through the efforts of the extension agronomist and later took on commercial proportions supported by associations of growers who assumed responsibility for the work, including the expense of inspection and certification of such small grains as corn, wheat, oats, and rye, potatoes, and grass seeds.

The number of demonstrations with legumes and forage crops, 66,261, reported by 1,067 agents in 47 States, is a 65 per cent increase over the preceding year. There were conducted 31,286 adult result demonstrations with cereals by 1,311 agents in 47 States, which is a slight increase over 1922. In the case of special crops, such as potatoes and tobacco, there has been little increase in the amount of work reported, while the number of demonstrations with cotton has nearly doubled.

There were conducted 13,153 result demonstrations in all phases of corn growing with adults, while 17,293 boys and girls completed the work prescribed for them in the corn project. The adoption of improved corn practices on 171,080 farms were reported by 1,789 agents. Improved strains of seed were planted on 112,561 farms and 39,185 tested corn seed for germination prior to planting.

Work in soil fertility was reported by 1,980 county extension agents in 48 States. During the year 34,550 result demonstrations were completed or carried through the year, and 323,009 different farms were reported as having adopted better soil practices. The advice of the agents in the use of commercial fertilizers was followed on 170,059 farms, and in the use of lime and limestone on 63,719 farms; 60,743 took better care of farm manures and 57,429 began the practice of plowing under green manure crops to increase soil fertility.

Under development of sources of limestone for soil improvement the principal problem has been an economic and physical one. Carrying charges for long hauls have in many instances prevented the use of lime. Consequently, local sources of lime have been developed and storage bins built, making it easily accessible at the time of the year when the farmer can haul a load from his home to the market and return with a load of lime. Marl beds as a source of lime were also developed in several States.



In addition to making lime accessible at reasonable rates, one-fourth of the States have conducted work on standardizing formulas and interesting both the trade and the farmers in the use of high-analysis fertilizers. To attain this end conferences were held with manufacturers of fertilizers, those in charge of State fertilizer inspection, and the agronomists at the experiment stations.

**Horticulture.**—In fruit growing the outstanding activities have been the pruning and spraying of orchards. Pruning and spraying were conducted in New York as a joint piece of extension work by the plant pathologist, entomologist, and horticulturist cooperating in the commercial orchards. The actual pruning and spraying was conducted as a paid service, men being employed by orchardists on the advice of the college extension specialist interested in the work. The method of pruning followed the usual teachings of the college of agriculture. The spraying was conducted in the commercial orchards with the usual materials, but the time of application was determined by weather forecasts furnished by the Weather Bureau. In a few States where home orcharding is being promoted, spray rings were formed consisting of as few people as practicable. They joined in the purchase of the spraying outfit and materials, and in some cases in the employment of a man who conducts the actual spraying operations.

In vegetable production one of the outstanding lines of work conducted in cooperation with the plant pathologists was the treatment of potatoes and sweet potatoes for the prevention of disease. In addition, the building of sweet-potato storage houses has been promoted, with demonstrations of the success of these houses in preventing storage losses. The success of some of the work in spraying was due to cooperation of local business firms in the plans of the specialists and county agents in its promotion. The merchants put in the stock and equipment necessary to supply purchasers as desired. In some instances, dealers were furnished with circulars on the control of insects and diseases which could be distributed with prepared spray mixtures or with supplies of spray materials.

Cooperation with the nutrition specialists has brought about increased numbers of home gardens and fruits to give variety and add nutritive qualities to the home diet. This has been stimulated in one State by the offering

of prizes for the best gardens, and especially those that provide at least two fresh vegetables for every day in the year. Home gardens have produced in the past year increased quantities of vegetables for canning for winter use.

**Plant Pathology.**—One of the most important phases of plant pathology extension was in the selection of seed for freedom from disease. This work has two phases, one in the seed-producing territory, the other in the seed-consuming territory. In the seed-producing territory the work was accomplished, first, by locating disease-free stocks; second, by growing these stocks in isolated and closely rogued fields; third, conducting field and bin inspections; fourth, training inspectors; fifth, conducting test plots with seed planted for certification; sixth, teaching by means of farmers' tours and other agencies.

The methods necessary for the introduction of disease-free seeds into the seed-consuming territories were, (1) conducting tests with seed from different sources; (2) inspecting seed-source crop tests; (3) establishing record demonstrations; (4) establishing by means of farmers' tours and other agencies the value of disease-free seed. To assist in the promotion of the work in the producing of better seed potatoes a motion-picture film has been prepared to show the process of conducting the work in seed-producing territories. The same plan has been carried out in the production of pure-seed supply of one or two of the cereals.

Extension agencies promoted the planting of disease-resistant varieties. Some of the State experiment stations have produced disease-resistant varieties of cabbage, tomatoes, and other vegetables. Pure-seed stocks have usually been made available by the States to reliable seedsmen for multiplication. An effort has been made to inform county agents as to the sources of supply in order that they may furnish the information to farmers on request.

Seed disinfection is one of the several means of control which has been applied to insure a satisfactory reduction of loss. This is one type of control which may be conducted at a central point of application. In one county in Indiana all the farmers treated their seed wheat by the hot-water method at a central station. Some threshers, in order to avoid the risk of contaminating their machines, refused to thresh where the treatment had not been practiced. Com-



munity seed treatment of potatoes has been begun in Wisconsin and Minnesota. In a few States the pathologist and the extension entomologist have met with the extension horticulturist or the agronomist and have worked out plans for the preparation and application of sprays to control both diseases and insects.

**Livestock.**—During 1923 livestock extension work, from a production standpoint, was an uphill undertaking on account of the consistently low prices in the livestock markets. These conditions forced the undertaking of economic measures, one of which was more effective methods of feeding. Increases in the returns from the animals sold were brought about, to some degree, through the organization of cooperative shipping associations. Other types of cooperation were also engaged in, such as the marketing of feeder cattle direct to growers in the Corn Belt. An outstanding example of cooperation was found in Colorado, where 12,500 cattle were handled through a cooperative organization dealing with a similar organization in Iowa, where the cattle were sold.

The general level of the quality of livestock production was also raised by the culling of both male and female breeding animals. The improvement of range pastures and the production and use of supplemental feeds, with reference to the influence on net returns, were also given much attention.

In 1923, 65,236 different farmers were influenced by extension work to adopt better practices in beef production, 1,673 result demonstrations were conducted with adults, and 4,453 boys and girls raised beef animals according to improved methods. Aid was given in obtaining purebred sires for 4,812 farms and purebred females for 1,781 farms. In cooperation with Federal, State, and county veterinarians 22,734 farmers were influenced to vaccinate for blackleg and 19,356 to test beef animals for tuberculosis.

The promise of immediate and usually satisfactory returns prompted much interest in poultry extension work. The poultry industry has been the means of helping to tide over many distressed farmers, and the year has brought out more forcibly than ever before the important part which poultry plays in successful farm operations. In many States poultry extension work was conducted by the county agricultural agents in cooperation with the specialists, while in others it was conducted by the home demonstration agents and the poultry specialists.

Culling has come to be generally adopted, and thousands of farmers and members of their families are doing the culling unassisted. In one or two States the farmers have been encouraged to employ specially trained persons to do the culling. The demonstration farm has become an important long-time piece of work.

Boys' and girls' club work has been a very helpful agency in the development of the poultry industry not only in the production of poultry but in the demonstration of good practices through home flocks, fair exhibits, and public demonstrations and talks given by the boys and girls. Demonstrations in the building of model poultry houses have been most successful under the "community building bee" plan where visitors take part in the construction.

The agencies for spreading the influence of poultry extension were automobile tours, field meetings, exhibits, folders, and bulletins. Circular letters, posters, and calendars also played an important part in keeping the work before the people.

More than 73 per cent of the county agents reporting, or 2,459 agents, mentioned work with poultry; 65,359 demonstrations were conducted with adults; 50,048 boys and girls demonstrated improved methods of chick rearing and poultry management; 133,911 farmers culled their flocks according to improved methods in order to increase efficiency in production; 70,867 farmers were assisted with feeding problems, and 70,276 in controlling insect pests. One or more poultry practices were modified on 309,719 farms.

Extension activities with swine were generally distributed throughout the Corn Belt, and some work was done in the West, East, and South, where the raising of hogs was encouraged to utilize farm waste and to provide pork and its products for the home. The use of better-bred animals has improved the general level of the type of hogs raised all over the country.

Extension agents gave assistance in procuring purebred boars for 13,379 farms and purebred gilts and sows for 15,027 farms; 30,000 farmers were assisted with swine-feeding problems; 30,910 farmers followed better methods of controlling insect pests; and 76,778 farmers were influenced by the agents, in cooperation with Federal, State, and local veterinarians, to vaccinate their animals for cholera. In all, swine practices were changed during the year on 146,869 farms.

In the Western or range States, winter feeding and better range management were two outstanding features of extension work with sheep. In the Central and Eastern States the practice of docking and castrating lambs was emphasized in Kentucky, Virginia, and Missouri. Although buyers have noted the adoption of this practice, it has not become sufficiently general to make large differences in the lamb market.

One interesting feature in sheep extension work has been the use of sheep, as well as swine, in the harvesting of a corn crop by turning them into the cornfield and allowing them to eat both ears and leaves. The work was demonstrated with great success in Idaho and Colorado. Each acre of corn in the Idaho demonstration produced a gain of 482 pounds.

In addition to the problem of producing more home-grown legume feeds and a better quality of silage, the problem of increasing the milk production per cow has been as important in 1923 as in any preceding year. The organization of cow-testing associations and the elimination of the low-producing cow by testing have been important phases of dairy extension. A modification of the standard cow-testing association plan by which the number of herds is increased and the expense lessened has been tried with reasonable success in a few States.

The second method of increasing milk production is a comparatively long-time process in which bull associations are the principal factor. In addition to the bull-association plan there has been a general stimulation incident to the better-sires campaign, to encourage farmers to purchase better bulls whether or not they are members of associations.

Extension workers have also promoted the better care of milk and cream, whether for the whole milk market or for manufacture into a high-class product, such as cheese or butter. This has been done by conducting demonstrations in better sanitary conditions in dairy barns, improving methods of cooling, arranging for frequent deliveries, and advocating improved methods of cleaning all utensils coming in contact with milk. The problem of inefficient feeding has been largely met by conducting feeding demonstrations, feeding schools, and forage-crop growing campaigns.

Dairy extension workers have cooperated with nutrition specialists in encouraging farmers who do not own

cows to obtain one or two to provide the family milk and butter supply. This work has been done largely through feeding demonstrations of children to bring about normal weight conditions by the use of a diet improved by the addition of milk.

Some phase of dairy extension work was reported by 2,247 agents, with a total of 315,569 farmers taking up improved dairy practices during the year. There were conducted 21,107 result demonstrations in dairying with adults, while 10,473 boys and girls demonstrated the advantages of improved methods in the care and management of dairy animals. During the year, 407 bull associations were organized with a membership of 6,997 farms. Records of dairy production were kept on 29,329 farms, 16,552 of which were members of cow-testing associations. Extension agents assisted 65,459 farmers in dairy feeding problems, and in cooperation with Federal, State, and county veterinarians influenced 197,399 farmers to test dairy animals for tuberculosis.

**Farm Management.**—Any plan of farm work and management that lessens the outlay of money, makes better use of time and economizes in labor, determines the farm-management program. To detect the leaks in these factors more account books were used than ever before. The keeping of accounts and the making of simple inventories are necessary to form the basis for making adjustments. The books are furnished at nominal cost. The farmers are brought together in a little group called a farm-account school, in which each farm enterprise is discussed with reference to the cost of conducting it as indicated by the farmers' own accounts. This work is particularly for the purpose of developing the habit of account keeping and is a guide in the weighing of each enterprise. The gradual increase of production per worker in 1920 as compared with 1910 indicates that there has been an increase of 8 acres of the principal crops per worker, an increase of half a horse per worker, and the use of nearly \$2 worth of machinery per acre of crops more than in 1910. Machinery figures were adjusted to a common price level. The general increase in agricultural products through this period, 1910 to 1920, amounted to 15 per cent and was accomplished by added efficiency and not by an increase in the number of farm workers. The same degree of efficiency seems to characterize the producing power per man in 1923.



Assistance was given to 16,164 farmers in the keeping of farm accounts; 6,018 boys and girls kept complete or partial accounts of the business on their home farms; 6,998 farmers made recommended changes in organization of the farm business; 9,546 farmers were advised concerning leases. Cost of production records were kept on 14,308 farms. Assistance in making better use of labor was given on 42,537 farms, and 24,569 farmers were helped to secure loans made through farm-loan associations or from local banks. The farm-account school, where farmers are brought together in small groups to take inventories, to start and close farm accounts, and to discuss costs of production, farm organization, labor efficiency, and other farm-management problems, has increased in popularity during the year.

**Marketing.**—During the year the Extension Service rendered assistance in connection with the organization of 1,853 new cooperative marketing associations and gave counsel to 4,409 other similar associations previously organized. Through these associations, or individually, 939,298 farmers or home makers were assisted with marketing problems. The total value of purchases by these farmers was \$43,628,152, with a reported saving of \$4,314,134. The total value of the sales reported was \$277,403,702, with a profit of \$21,158,941.

**Forestry.**—Forest planting, thinning, and improving the cutting of timber have claimed the greatest interest in forestry extension. A successful forest-planting program is somewhat dependent upon the source of cheap and easily-procured planting material. This is usually supplied from nurseries maintained by the States. In agricultural regions of the Middle West the production of fence posts has received the greatest attention. Many windbreaks have been planted also in this region. Plantings for the purpose of stopping soil erosion have been made in the hilly regions of the East and South. The initiation of a planting plan requires much personal service until a few demonstration plantings have been established. After a year or two a county or state-wide program can be organized. In carrying out the planting plan it is necessary in States having no State forester to develop very close cooperation between the State department of forestry and the county agent, the farmer, and the extension specialist.

Demonstrations in thinning and improving woodlands were especially successful in natural-growth pine. Many of the trees to be removed are large enough to be utilized for fuel, posts, or low-grade timber, thereby reducing the cost of the work. The county agent and the owner lay out a rectangle of perhaps a half acre. Each of the boundaries is marked and a check plot is reserved. As the demonstration advances the neighboring farmers are invited to be present when the trees are marked for cutting. The actual work of removing the marked trees is carried on by the owner and the products are often piled where they can be measured and viewed.

The treating of wood to preserve it has developed as a forestry-extension proposition. The fast-growing timbers decay rapidly, making treatment with creosote necessary. The initial outlay of \$50 to \$100 necessary for constructing a fence-post treating plant has prevented the development of the project to some degree, but, in spite of this fact, in Iowa 13 demonstrations of wood preservation were made in 1923. The object of the demonstration is to show how to set up a farm creosoting plant and to show the actual savings which can be accomplished. The creosoting of floor boards made of native cottonwood timber has been conducted to prevent powder-post beetles from attacking the wood.

A few demonstrations have been made in the application of the principles of timber estimating. With a knowledge of these principles the farmer can meet the buyer on more equal terms than he can without it. The difficulties encountered in doing this work have been some technical features of calculation which have been overcome in part by the aid of what is called a "cruiser's stick," such as has been worked out by the Federal Farm Land Bank of Springfield, Mass.

**Agricultural Engineering.**—The extension work in agricultural engineering has brought the farm land to a higher state of production by drainage, terracing, irrigating, and clearing of stumps. Farm life has been made more enjoyable and attractive by the installation of water systems, electric lights, septic tanks, and heating plants. In many instances the profits derived from the raising of livestock and poultry have been increased by properly constructed buildings, the use of self-feeders, and the construction of silos.



The lifetime of farm machinery and farm buildings has been increased by teaching proper care and repair.

The general agricultural depression directed the drainage extension work toward the construction of open drains rather than tile drains. In many States drainage districts have been organized, as in previous years, for the purpose of planning and constructing a general system to serve an entire community. The extension specialist has endeavored to demonstrate the fact that increased production from drained land will amply pay for the improvement. Meetings are held on the farm during the course of construction of the drains and the principles of correct drainage are explained.

In some of the far Western States demonstrations were made in the conservation of flood water by impounding, the development of pumping plants, and the consolidation of small irrigation systems. Field meetings were advertised as "irrigation days" in California, and various features of the efficiency of one type of irrigation were demonstrated. Depth of penetration in check or basin systems of irrigation with measured amounts of water and various other features were emphasized.

The prevention of erosion stands nearly equal in importance to drainage. The greatest need for terracing seems to be found in the Southern and Central States, and the work has been conducted by means of demonstrations and terracing schools. Farmers were not advised to terrace their lands where the benefits derived would not equal the cost of the improvement. The demonstrations consisted in laying out terraces and supervising their construction. Motion pictures and still pictures have been used in the terracing schools to show the methods employed. Instruction has also been given in the use of terrace drags, farm levels, and level rods.

The preparation and distribution of standard plans for buildings and farmsteads has been the largest single feature contributed for the improvement of farm buildings. In some instances lumber dealers have had placed in their hands for distribution sets of blue prints and bills of materials to be given to prospective builders of hog houses, poultry houses, etc.

The need for farm-home conveniences has been brought out by the kitchen score card and other methods of determining the ratings of farm-home equipment by some established

standard. Many demonstrations have been made at county and State fairs where water systems have been exhibited and other mechanical devices have been used to show the advantages of these conveniences. In one State water-supply schools were conducted, the demonstration equipment being carried on a truck.

**Nutrition.**—Only within the past two years has there been a general tendency toward dividing home economics as a general subject into the different lines of work under such names as nutrition, clothing, and home management. Human nutrition has taken its place in the field of home economics as feeding has in the animal-husbandry work in the larger subject of agriculture, and many of the problems very closely resemble those in the field of animal feeding. The factors of nutritive value, economy in purchasing or production, palatability combinations, preservation, and corrective feeding may be common to both.

In the field of human nutrition demonstrations in improving food habits have been of prime importance. In order to contribute to the establishing of proper food habits five factors have been considered: (1) The physical condition of members of the family, (2) food selection habits, (3) the family food supply, (4) food preparation, and (5) menu building.

In the first and second cases the height-weight standards and the score cards have played an important part in adding to the information an individual may have as to the deviation from standards. Consciousness of this deviation has caused many individuals to correct their food habits. In addition the shortage of certain food supplies and the improper preparation of food have been corrected by growing many leafy vegetables in the home garden in addition to those usually grown, and by having demonstrations in food preparation. It has quickened the use of the food-preservation budget necessary to give some idea as to the food supply for winter months, and has also caused an increased use of eggs, milk, and other dairy products and home-grown meat. Food-preparation demonstrations have followed the use of the score card in the correction of food habits. Meals have also been constructed to please the palate and tempt the appetite in conformity with the recognized menu-building standards. The score card has stood out as an invaluable factor in prompting action for requiring bet-

ter practices and improving the food habits of the family.

Nutrition work lends itself to being broken up into simple demonstrations wherein local leaders can be used in transmitting it from the home demonstration agent and the specialist to thousands of persons whom neither the specialist nor the home demonstration agent can reach personally.

During the year outstanding work has been done in the correction of food habits among club boys and girls and the children in the public schools, who have been influenced many times by the interest taken in the work by parent-teacher associations and by demonstrations made under the auspices of the public-school authorities.

**Clothing and Millinery.**—The proper selection of clothing materials was taught in 8,683 demonstrations with adults and 10,967 demonstrations with juniors. As a result the improved practices taught were adopted in 46,156 homes. There were conducted 67,294 junior demonstrations and 46,177 adult demonstrations in sewing and garment making; in 207,889 different homes use was made of the information taught in these demonstrations, and 57,952 dress forms were made as aids to better construction. Remodeling and renovating old garments and articles to make them better suited for present use were taught in 7,428 demonstrations with adults and 4,483 demonstrations with girls, while in 32,002 homes practical use was made of this work during the year.

Hat making has continued to have a strong appeal with rural women and girls both from the standpoint of economy and satisfaction with the finished product. The methods taught in the 21,238 demonstrations conducted with adults and the 6,847 demonstrations completed by the girls enrolled in club work were applied in 76,984 homes.

#### DEVELOPMENT OF COUNTY EXTENSION AGENCIES

In presenting the extension program outlined for 1923 the extension agents associated with them 182,350 local leaders. A total of 1,034,032 persons were members of county extension organizations and adult clubs. There were also organized 32,673 junior clubs with an enrollment of 459,074 boys and girls. The county extension agents visited personally 609,887 different farms and 222,132 different homes. Nearly 4,000,000 office and telephone calls were received and nearly 3,500,000 letters were

written in connection with requests for information. More than 16,000,000 persons were reached in the 420,737 meetings arranged for or participated in by the county workers.

There were conducted 721,448 completed demonstrations with adults, while 428,746 completed demonstrations were carried out by the juniors. New or improved practices were reported as having been adopted in 5,462,526 farms or homes through the influence of the extension forces.

The 2,310 county agricultural agents carried on organized extension work in 23,213 communities and were assisted in such work by 125,071 volunteer leaders; 282,395 demonstrations were carried on with adults and 128,705 with juniors, and 3,860,437 farmers or home makers were influenced more or less directly by the agricultural agents to adopt better agricultural or home economics practices.

Organized extension work was carried on by the 949 home demonstration agents in 13,377 communities. Through the influence of 438,099 result demonstrations with adults and 254,006 with juniors, 1,546,256 home makers adopted improved practices in connection with the various activities centering in the home.

In 1923, 459,074 boys and girls were definitely associated with extension work, 50 per cent of whom carried their work to completion. Of the projects undertaken by these boys and girls, 59 per cent of the 722,508 projects were finished. This was an increase of 120,000 over the number of projects completed by boys and girls in 1922. As in previous years, the corn, potato, cotton, vegetable gardening, dairy, poultry, swine, food preparation, food preservation, and clothing projects received greatest emphasis with juniors as measured by the number enrolled. Of the 3,338 agents submitting annual reports, 2,747, or 82 per cent, mentioned work with juniors.

The 264 negro men and women agents obtained the active cooperation of 14,367 leading colored farmers and farm women in carrying out the local extension programs developed in 2,965 communities. A total of 847,078 people were reached through meetings; 107,678 completed demonstrations were conducted with adults, and 69,917 completed demonstrations with juniors. Through the influence of the negro extension agents, 388,558 farmers or home makers took up some of the better practices recommended.

**Outlook.**—The outlook is good for continuing extension work on about the



same plane and along about the same lines as at present. Now that material expansion has ceased, attention is being centered more and more on efficiency in the methods employed and a fuller utilization of all the agencies for extension, such as the press, the tour, the campaign, the local and community fair, charts, lantern slides, motion pictures, and exhibits. Increasing attention is likewise being given to the psychology and the art of teaching. It is recognized, however, that the extension system is only partially complete, and in the near future steps must be taken to strengthen both the home demonstration work and the boys' and girls' club work.

### OFFICE OF MOTION PICTURES

The Office of Motion Pictures has continued under the direction of Fred W. Perkins, without change of personnel. Definite accomplishments during the fiscal year include the following:

Completion of 26 new motion pictures of one reel or more, the total number of reels being 37.

Revision of 35 old films.

Beginning of scenario or production work, or both, on 23 new films.

Addition of 240 new prints, totaling 368 reels, to the department's stock available for distribution, bringing the total number of reels to 1,537.

Circulation of department films through extension workers and others to a partially reported audience of 2,281,739, and to a total audience believed to be in excess of 8,000,000.

Authorization of sale of 251 prints, totaling 310 reels, at a cost to purchasers of, approximately, \$12,500.

Adoption of definite policies in the conduct of the motion-picture work.

Publication of a new indexed list of our 182 subjects, and preparation of manuscript for a new circular on the use of motion pictures by extension workers.

### GROWTH IN FILM DISTRIBUTION

The actually reported audience for our films during 1924 was considerably smaller than that reported for 1923, but it is believed that the audience has continued to grow. The number of film shipments from the laboratory during the year was greater than in any previous year, but unusual difficulty was experienced in obtaining complete reports of attendance at showings from film users. The number of shipments made during 1924 was 3,199, compared with 2,715 in 1923 and 2,066 in 1922.

No figures were obtained from some of the large exhibitors, including theaters and other institutions, nor from the numerous purchasers of prints of our films. As the department films being circulated by pur-

chasers outnumber the copies owned and circulated by the department itself, the estimated total of 8,000,000 is believed to be conservative. Circulation of portions of our films through the theatrical film "news weeklies" is not figured in this total. Circulation through this medium has been obtained several times in the past year and would add millions to the audience.

The purchase of prints by authorized persons and institutions has continued to be active, although the total of purchases during the past year is about 15 per cent less than in the previous year. Among the purchasers have been State agricultural colleges, agencies of foreign governments, and other institutions likely to give wide and advantageous use to the films.

### NEW FILMS COMPLETED

The following motion pictures were completed and placed in distribution during the fiscal year:

Sir Loin of T Bone Ranch (3 reels, Bureau of Animal Industry).

The Woolly West (2 reels, Bureau of Animal Industry).

Clean Herds and Hearts (4 reels, Bureau of Animal Industry).

Bob Farnum's Ton Litter (2 reels, Bureau of Animal Industry).

Where Uncle Sam Raises Poultry (1 reel, Bureau of Animal Industry).

Beets from Seed to Sugar Bowl (1 reel, Bureau of Plant Industry and Bureau of Chemistry).

Sugar Cane and Cane Sugar (1 reel, Bureau of Plant Industry and Bureau of Chemistry).

Blisters Rust—A Menace to Western Timber (2 reels, Bureau of Plant Industry).

Hidden Foes in Seed Potatoes (1 reel, Extension Service and Bureau of Plant Industry).

Seeing Washington (1 reel, Extension Service).

Limestone for Ailing Clover (1 reel, Extension Service).

The Corn-Belt Derby (1 reel, Extension Service).

Better Seed—Better Crops (1 reel, Extension Service).

Cassina (1 reel, Bureau of Chemistry).

Trees of To-morrow (2 reels, Forest Service).

Forests Green or Forests Gray (1 reel, Forest Service).

Corn-Borer Control in the Corn Belt (1 reel, Bureau of Entomology).

Fighting Insects with Airplanes (1 reel, Bureau of Entomology).

Hoppers (2 reels, Bureau of Entomology).

Wheat or Weeds (1 reel, Bureau of Agricultural Economics).

Citrus Fruits in Florida (2 reels, Bureau of Agricultural Economics).

Rice from Paddy to Bowl (1 reel, Bureau of Agricultural Economics).

The Modern Pied Piper (2 reels, Bureau of Biological Survey).

Poison (1 reel, Insecticide and Fungicide Board).

Uncle Sam—World Champion Farmer (1 reel).

Fire—The Prairie Demon (1 reel).



The pictures named above number 26, two less than were completed in the preceding year. The smaller number is due to the greater emphasis placed on adequate preparation and better quality. As a result, our pictures are winning an excellent reputation among educational films.

#### NEW FILMS IN PREPARATION

New films, on which considerable preparatory or actual photographic work has been done and which should be completed within the next four months, include the following:

- The Green Barrier (Bureau of Animal Industry).
- Salvation of Strawberries (Bureau of Plant Industry).
- Hog Breeds and Hog Management (Bureau of Animal Industry).
- Beans or Beetles (Bureau of Entomology).
- The Horse and Man (Bureau of Animal Industry).
- Southern Forest Insects (Bureau of Entomology).
- Planting Pines for Profit (Forest Service).
- Dual Purpose Trees (Forest Service).
- From Seed to Sawmill (Forest Service).
- Weighed in the Balance (Bureau of Dairying).
- The Travels of a Banded Duck (Biological Survey).
- Laying Lumbrius Low (Bureau of Plant Industry).
- Wheat Smut Treatment (Bureau of Plant Industry).
- Weather Bureau Work (Weather Bureau).
- Pan-American Highway Tour (Bureau of Public Roads).
- Boys' and Girls' Club Work (Extension Service).
- Cotton Variety Standardization (Extension Service and Bureau of Plant Industry).
- Satisfying Farm Life (Extension Service).
- Clean Milk Production (Bureau of Dairying).
- Farm Accounting (Bureau of Agricultural Economics).
- Household Organization (Bureau of Home Economics).
- Sheep in Psalm and Sage.
- Pan and Ceres in the Movies.

#### NEEDS OF THE WORK

Motion pictures have become important instruments in the extension, educational, and publicity work of the Department of Agriculture. Requests for the use of films have increased several times over and will probably continue to grow. Recommendations from various bureaus of the department for the production of new films continue to be greater than the capacity of our force and facilities. No considerable expansion in distribution is possible without additional funds for the purchase of prints, and no increased production of new films seems to be possible without additional per-

sonnel. A reasonable addition to personnel and to operating funds will give results worthy of the expenditure.

#### OFFICE OF EXHIBITS

##### ORGANIZATION

During the fiscal year the exhibits activities of the department, which are under the direction of J. W. Hiscox, were segregated into the following divisions, with an officer in charge of each: (1) Administration, (2) operation, (3) planning and designing, (4) production, (5) distribution, and (6) engineering and warehousing. The adoption of this plan of organization enables the office to conduct its work in a more systematic and economical manner than heretofore.

An information service was also started, which procures and records material on exhibits from outside sources and studies books, periodicals, and equipment relating to exhibits work. Special attention has been devoted to expanding the information on such subjects as the application to exhibits of the principles of visual appeal, materials for the making of models, special reproduction processes, and lighting effects.

##### DEVELOPMENTS IN TECHNIQUE

Among the mechanical devices developed during the year was a method of showing two or three scenes in the same space by having one scene dissolve into another by means of screens and controlled electric lighting operated by a flasher. Several such exhibits were constructed, each of which was unusually successful from the standpoint of attracting attention, holding interest, and presenting the message effectively.

A second method of obtaining two scenes within the same space has been developed through a study of the effect of lights of different colors on colored surfaces. Through the use of this method, combined with a device for changing the color of the light automatically without the use of a motor, a plan has been worked out for an inexpensive exhibit with automatic change of scene.

Another problem solved was the mounting of bromides on metal so that they would remain in place under all weather conditions. Success was attained by the use of metal with a grained surface, to which bromides mounted with paste adhered satisfactorily. Metal instead of wall board is now much used for small cut-outs,

as the edges are less noticeable. To facilitate removal of dust and finger marks and avoid frequent repairing and scrubbing, varnish and other waterproofing surfaces have been tried on exhibit panels with considerable success.

Several new types of exhibits have been developed, including one which furnishes the same wall space as the older type and which when packed for shipping is 30 per cent lighter. An exhibit booth was constructed which gives 33 per cent more wall space than the type now in use and requires 25 per cent less floor space. This special new type of booth consists of five panels 4 by 4 feet instead of three sections 4 by 8 feet. The panels of this booth are so constructed that both sides can be used for presenting subject matter. This increased the efficiency of the new booth as compared with the old type by about 56 per cent. Because the panels of the new booth are smaller, they can be packed much more compactly for shipment. The crates are lighter and more easily handled, and express and freight costs will be reduced about 27 per cent.

#### EXHIBITIONS

The department is gradually building exhibits of recognized excellence. However, the responsibility of the department in disseminating information through exhibits does not end with the construction of a piece of exhibit material, nor are its aims thus attained. The aim of the Office of Exhibits during the past year has been to obtain more adequate presentation of exhibits through cooperation with State extension workers and State and other local agencies. Circulation is important, but the department is limited in its selection of places or occasions at which to exhibit by its appropriation for this work, which provides only for exhibitions at State, interstate, and international fairs and expositions. However, exhibits prepared for showing at State fairs were loaned for use at many other places on the payment of transportation and other direct expenses. In this way a distribution much larger than ever before in the history of the department was obtained. During the year, 160 exhibitions were made within the United States. This is an increase of 56 exhibitions over the fiscal year 1923, yet the demand from fair associations and similar organizations was so great that it could not be fully met.

Quantity distribution is not necessarily the most effective distribution.

It accomplishes much, however, and until the limiting language of the appropriation is changed there can be little selection of exhibition points. Adequate distribution can not be obtained until exhibits can be sent to the points where they may be seen under appropriate conditions by the maximum number of those whom it is desired to reach.

**Financial Cooperation.**—During the fiscal year 78 fairs and expositions deposited with the disbursing officer of the department \$9,238.73 to cover cost of transporting and installing exhibits. The transportation cost was prorated and each fair deposited with the disbursing officer of the department sums ranging from \$98.75 to \$182.77, depending upon the size of the exhibit received, for disbursement by him. A considerable saving in transportation costs was accomplished for the depositors, due to the liberal concessions secured from the transportation companies, giving free return on a large number of exhibits from their last point of display to Washington, D. C., or to Alexandria, Va.

The cost to the department for participation in the fairs and expositions during the fiscal year was approximately \$107,200. Adding to this the deposited "special fair" funds of \$9,238.73 makes a total for the entire project of approximately \$116,400. The average unit cost of the 160 exhibitions was therefore about \$732.

**Exhibition Circuits.**—Circuits of carload exhibits were arranged as usual during the year, and 50 of the 160 exhibitions were made in this way. One or more department representatives were at each of these exhibition points for demonstration purposes. These men were detailed from the bureaus of the department interested in the subject matter of the exhibits. Through this cooperation the office was enabled to make exhibits available to at least twice as many places and to reach twice as many people as otherwise would have been possible.

**Special Exhibitions.**—Special showings were made, as usual, at the National Dairy Exposition and the International Livestock Exposition. For the National Dairy Exposition an allotment of \$25,000 was made by Congress for the construction of an exhibit. Two carloads of material were prepared for this exposition, the exhibit occupying a space 16 feet wide along the entire northwest side of the Manufacturers Building at the State fairgrounds, Syracuse, N. Y., with a total floor space of 6,080 square feet. The



estimated attendance at the exposition was 90,000, including delegates attending the World's Dairy Congress from many foreign countries. These representatives unanimously expressed their approval of the department's exhibit, and it created much favorable comment from leaders in educational work and in the agricultural press. A special feature was a scenic exhibit 90 feet long, showing in three sections the development of dairying from a primitive to an advanced stage. Size and realism made this exhibit unusually attractive. Other exhibits which contained objects or had motion were also noticeably attractive.

At the International Livestock Exposition at Chicago the department had what many thought was the most effective exhibit of the year. Here the effect of those factors which attract was demonstrated. Motion, light, objects, and demonstrations were combined with most satisfactory results. Probably the best of the features here was the display of live steers and hogs, representing the various market grades, with wholesale and retail cuts of meats from similar animals. There was no idle time for the demonstrators in this exhibit.

**Exhibits Other than at Fairs.**—Exhibitions have been made before a large variety of organizations and at occasions of widely differing character. Fairs and expositions are the largest class of exhibit occasions, ranging from trades expositions and shows through various specialized expositions to the general agricultural fairs. Textile, chemical, electrical, canning, automobile, and fire-prevention expositions are among those which call upon the department for exhibits. Twelve exhibitions were

made at colleges. Medical societies, banks, schools, and museums were among others which asked the department for exhibit material. Numerous applications were of necessity declined.

Another enlarging opportunity for exhibits is their use on agricultural demonstration trains. Several applications were received during the year from large railroad companies. These trains planned to carry the information developed by the department and the colleges directly to the farmers, as well as to business men, bankers, and others who are interested in agricultural progress. Many farmers and others who would never attend a fair, institute, or short course will visit a demonstration train. These movable schools with lectures and demonstrations reach the heart of farming communities and provide opportunities for the spread of agricultural information often more valuable than exhibitions at fairs, because they are more readily accessible and because the distracting elements often common at fairs are not present.

Applications for exhibits at other occasions than State and interstate fairs were met by asking the payment of handling, transportation, and installation expenses. Even this service, however, causes such a drain on the time of the office personnel as to interfere seriously with State-fair work. It has become necessary, therefore, to decline applications of such character until a way to finance the work has been provided. This decision is made with regret, for some of the very best exhibit opportunities come under this type. It will mean also that there will be a decided drop in the number of showings made during the coming year.

*List of exhibits held during the fiscal year ended June 30, 1924*

Place	Occasion	Dates
Albany, N. Y.	New York State Veterinary Medical Society	June 9-10, 1924.
Albany, Oreg.	Santiam Forest Exhibit <sup>1</sup>	Sept. 3-6, 1923.
Albuquerque, N. Mex.	United States Good Roads Show	May 21-31, 1924.
Alexandria, Va.	Alexandria Trades Exposition	Apr. 7-10, 1924.
Ames, Iowa	Farm and Home Week, College of Agriculture.	Jan. 28-Feb. 2, 1924.
Do.	Veishea College Celebration	May 14-17, 1924.
Amherst, Mass.	Massachusetts Agricultural College	Oct. 1-30, 1923.
Ann Arbor, Mich.	University of Michigan (engineering class demonstrations).	Feb. 11-16, 1924.
Arkansas (State)	Agricultural train, St. Louis Southwestern Railway (cotton exhibit).	Feb. 18-Mar. 21, 1924.
Atlanta, Ga.	Georgia State Museum	June 15-Aug. 15, 1924.
Atlantic City, N. J.	Home and City Beautiful Exposition	June 16-Sept. 8, 1923.
Aurora, Ill.	Central States Fair and Exposition <sup>2</sup>	Aug. 17-25, 1923.

<sup>1</sup> Exhibits made by Forest Service districts in West and reported to Washington.

<sup>2</sup> These fairs had two separate exhibits.



*List of exhibits held during the fiscal year ended June 30, 1924—Continued*

Place	Occasion	Dates
Baltimore, Md.	Baltimore Poultry Show	Dec. 3-9, 1923.
Do.	Engineering Show, Johns Hopkins University.	Apr. 11-12, 1924.
Do.	Maryland Academy of Science (conservation pageant).	Oct. 29-Nov. 4, 1923.
Bethany, Mo.	North Missouri District Fair	Sept. 4-8, 1923.
Billings, Mont.	Midland Empire Fair	Sept. 18-21, 1923.
Boston, Mass.	International Textile Exposition	Oct. 29-Nov. 3, 1923.
Do.	Public Health Exposition	Oct. 6, 1923.
Buffalo, N. Y.	National Canners' Association	Jan. 21-26, 1924.
Do.	National Safety Counsel	Sept. 20-Oct. 7, 1923.
Burlington, Vt.	State Dairymen's Convention	Jan. 8-10, 1924.
Cambridge, Md.	University of Maryland (county demonstrations).	Aug. 3, 1923-Mar. 31, 1924.
Chapel Hill, N. C.	State Forester (educational exhibits)	Sept. 25-Nov. 17, 1923.
Chattanooga, Tenn.	Chattanooga Interstate Fair	Sept. 29-Oct. 6, 1923.
Chehalis, Wash.	Southwest Washington Fair	Aug. 20-25, 1923.
Chicago, Ill.	American Medical Association	June 9-13, 1924.
Do.	Chicago Auto Show	Jan. 27-Feb. 2, 1924.
Do.	Good Roads Show	Jan. 14-27, 1924.
Do.	International Livestock Show <sup>2</sup>	Dec. 1-8, 1923.
Cleveland, Ohio	Association of Ice Cream Supply Men	Oct. 22-27, 1923.
Do.	Cleveland Trust Co.	Nov. 9, 1923-Mar. 13, 1924.
Collinsville, Ill.	Madison County Poultry Association	Dec. 6-9, 1923.
Columbia, S. C.	South Carolina State Fair	Oct. 22-28, 1923.
Columbus, Ohio	Bureau of Animal Industry	July 18-Oct. 1, 1923.
Do.	Midwest Drug and Health Show	Apr. 21-26, 1924.
Do.	Ohio State Fair	Aug. 27-Sept. 1, 1923.
Coronado, Calif.	League of California Municipalities	Sept. 10-14, 1923.
Crystal Falls, Mich.	County Fair	Sept. 12-15, 1923.
Denver, Colo.	National Western Stock Show	Jan. 19-26, 1924.
Des Moines, Iowa	Des Moines Third Annual Building Exposition on.	Mar. 24-29, 1924.
Do.	Iowa State Fair and Exposition <sup>2</sup>	Aug. 22-31, 1923.
Detroit, Mich.	Michigan State Fair <sup>2</sup>	Aug. 31-Sept. 9, 1923.
Do.	World Motor Transport Congress	May 21-24, 1924.
Dillon, Mont.	Stockmen's Convention	Apr. 24-26, 1924.
Dufur, Oreg.	Armistice Day Parade <sup>1</sup>	Nov. 11, 1923.
Edenton, N. C.	Edenton County Fair	Oct. 16-19, 1923.
Elgin, Oreg.	Whitman Forest Exhibit <sup>1</sup>	Sept. 25-28, 1923.
Fallon, Nev.	Nevada State Fair	Sept. 12-14, 1923.
Fargo, N. Dak.	Interstate Fair	July 9-14, 1923.
Ferry, Wash.	Ferry County Fair <sup>1</sup>	Sept. 13, 1923.
Fort Worth, Tex.	Southwestern Exposition and Fat Stock Show.	Mar. 8-15, 1924.
Fresno, Calif.	Fresno District Fair	Sept. 24-29, 1923.
Gainesville, Fla.	Farmers' Week, College of Agriculture	Aug. 6-12, 1923.
Do.	University of Florida	Feb. 13-16, 1924.
Grand Forks, N. Dak.	North Dakota State Fair	July 16-21, 1923.
Harrisburg, Pa.	Farm Products Show	Jan. 21-26, 1924.
Harrisonburg, Va.	State Dairymen's Show	Mar. 3-8, 1924.
Hartford, Conn.	Connecticut Dairy Association Meeting	Jan. 23-24, 1924.
Henderson, Ky.	Eckert Packing Co.	Apr. 25, 1924.
Do.	Pure Food Exposition	Apr. 24-26, 1924.
Hopkinsville, Ky.	Milk for Health Campaign	Oct. 22-27, 1923.
Hot Springs, Ark.	Forest Production Week	Apr. 21-27, 1924.
Hot Springs, N. C.	Hot Springs Schools	Dec. 8, 1923.
Huron, S. Dak.	South Dakota State Fair	Sept. 10-14, 1923.
Ithaca, N. Y.	Department of Forestry, Cornell University	Sept. 1-30, 1923.
Jacksonville, Oreg.	Jackson County Fair <sup>1</sup>	Sept. 12-15, 1923.
Kansas (State)	Dairy and livestock train, Missouri Pacific Railway.	Mar. 31-May 25, 1924.
Kansas City, Mo.	Kansas City Auto Show	Feb. 9-16, 1924.
Do.	Missouri State Poultry Show	Dec. 11-15, 1923.
Kingston, R. I.	Rhode Island State College	May 5-10, 1924.
Kinston, N. C.	Eastern Carolina Exposition	Apr. 5-19, 1924.
Laconia, N. H.	Hospital Bazaar	Nov. 2-3, 1923.
Lewiston, Idaho	Lewiston-Clarkston Tri-State Fair	Sept. 11-15, 1923.
Lewiston, Me.	Maine State Fair	Sept. 3-6, 1923.
Lincoln, Nebr.	Nebraska State Fair <sup>2</sup>	Sept. 2-7, 1923.
Louisiana (State)	Agricultural train, St. Louis Southwestern Railway (cotton exhibit).	Feb. 18-Mar. 21, 1924.
Louisville, Ky.	Good Roads Association, Kentucky State Fair.	Sept. 10, 1923-Jan. 10, 1924.
Macon, Ga.	Georgia State Fair	Oct. 23-27, 1923.
Madison, S. Dak.	Lake County Farm Bureau	Aug. 15-Oct. 22, 1923.
Madison, Wis.	University of Wisconsin	Feb. 11-16, 1924.
Do.	Wisconsin State Beekeepers' Chautauqua	Aug. 13-17, 1923.

<sup>1</sup> Exhibits made by Forest Service districts in West and reported to Washington.<sup>2</sup> These fairs had two separate exhibits.

*List of exhibits held during the fiscal year ended June 30, 1924—Continued*

Place	Occasion	Dates
Mankato, Kans.	Mankato County Fair	Oct. 10-15, 1923.
Meridian, Miss.	Mississippi-Alabama Fair	Oct. 8-13, 1923.
Miller, S. Dak.	Hand County Corn and Grain Show	Dec. 6-8, 1923.
Milwaukee, Wis.	Wisconsin Products Exposition	Dec. 1-8, 1923.
Do.	Wisconsin State Fair	Aug. 27-Sept. 2, 1923.
Missouri (State)	Dairy and livestock train, Missouri Pacific Railway.	Mar. 31-May 25, 1924.
Mount Morris, N. Y.	Livingston County Farm Bureau	Aug. 6-Sept. 30, 1923.
Muskogee, Okla.	Oklahoma Free State Fair	Oct. 1-6, 1923.
Nashville, Tenn.	Tennessee State Fair	Sept. 17-22, 1923.
Do.	Tennessee State Highway Department	July 25, 1923-Feb. 28, 1924.
New Haven, Conn.	Connecticut Forestry Association Meeting	Jan. 26, 1924.
New York, N. Y.	Fire Prevention Exposition	Oct. 8-13, 1923.
Do.	New York Auto Show	Jan. 5-12, 1924.
Norfolk, Va.	Great Norfolk Fair	Sept. 3-8, 1923.
Oakland, Calif.	Pacific Slope Dairy Show	Oct. 29-Nov. 3, 1923.
Okanogan, Wash.	Okanogan County Fair <sup>1</sup>	July 2-4, 1923.
Phoenix, Ariz.	Arizona State Fair <sup>2</sup>	Nov. 12-17, 1923.
Pomona, Calif.	Los Angeles County Fair	Oct. 16-20, 1923.
Portland, Oreg.	Pacific International Livestock Show	Nov. 3-10, 1923.
Providence, R. I.	Hospital Trust Co.	July 20-Sept. 30, 1923.
Pueblo, Colo.	Colorado State Fair <sup>2</sup>	Sept. 24-29, 1923.
Pullman, Wash.	Forestry Fair, State College of Washington <sup>1</sup>	Nov. 17, 1923.
Raleigh, N. C.	North Carolina Industrial Association	Oct. 23-27, 1923.
Raton, N. Mex.	Northern New Mexico State Fair	Sept. 11-14, 1923.
Reading, Pa.	Berks County Conservation Association	Jan. 12, 1924.
Richmond, Va.	Richmond's Ninth Auto Show	Mar. 8-15, 1924.
Do.	Holstein-Friesian Association Meeting	June 1-7, 1924.
Do.	Virginia State Fair	Oct. 1-6, 1923.
Rochester, N. H.	Rochester Fair <sup>2</sup>	Sept. 25-28, 1923.
Sacramento, Calif.	California State Fair	Sept. 1-9, 1923.
Saginaw, Mich.	Saginaw County Fair	Sept. 10-15, 1923.
St. Louis, Mo.	Tenth Triennial Convention of Council of Jewish Women.	Nov. 11-16, 1923.
St. Paul, Minn.	Family Budget Demonstration, University Farm.	Mar. 8-Apr. 29, 1924.
Do.	Minnesota State Fair	Sept. 1-8, 1923.
Salem, Oreg.	Oregon State Fair	Sept. 24-29, 1923.
Savannah, Ga.	Savannah Tri-State Fair	Oct. 27-Nov. 3, 1923.
Do.	Southern Forestry Congress	Jan. 28-30, 1924.
Shreveport, La.	Louisiana State Fair	Oct. 18-28, 1923.
Sioux City, Iowa.	Interstate Fair	Sept. 16-22, 1923.
Spokane, Wash.	Spokane Sportsmen's and Tourists' Fair	June 1-7, 1924.
Do.	Spokane Interstate Fair	Sept. 3-8, 1923.
Springfield, Ill.	Bureau of Animal Industry	July 18, 1923-Jan. 30, 1924.
Springfield, Mass.	Eastern States Exposition <sup>2</sup>	Sept. 16-22, 1923.
Stevenson, Wash.	Skamania County Fair <sup>1</sup>	Oct. 12-13, 1923.
Syracuse, N. Y.	New York State Fair	Sept. 10-15, 1923.
Do.	World's Dairy Congress and National Dairy Exposition.	Oct. 5-13, 1923.
Tampa, Fla.	South Florida Fair	Jan. 31-Feb. 14, 1924.
Taylorville, Ill.	Baltimore & Ohio Poultry Show	Dec. 10-14, 1923.
Texas State.	Agricultural train, St. Louis Southwestern Railway (cotton exhibit).	Feb. 18-Mar. 21, 1924.
Tieton, Wash.	Tieton Fair <sup>1</sup>	Oct. 12-13, 1923.
Timonium, Md.	Maryland State Fair	Sept. 3-8, 1923.
Toledo, Ohio.	National Farmers' Exposition	Dec. 7-15, 1923.
Topeka, Kans.	Kansas Free Fair	Sept. 10-15, 1923.
Trenton, N. J.	Mercer County Health Week	Mar. 31-Apr. 5, 1924.
Do.	New Jersey State Highway Department	Feb. 13-16, 1924.
Waco, Tex.	Texas Cotton Palace	Oct. 20-Nov. 4, 1923.
Wallowa, Oreg.	Wallowa County Fair <sup>1</sup>	Sept. 29-30, 1923.
Washington, D. C.	American Association of Museums.	May 10-13, 1924.
Do.	Eastern High School	Nov. 5-10, 1923.
Do.	General Federation of Women's Clubs	Jan. 7-12, 1924.
Do.	National Education Association Convention	June 29-July 4, 1924.
Do.	Radio Show	Mar. 19-26, 1924.
Do.	Southern Medical Association Convention	Nov. 12-15, 1923.
Do.	United Typothetae and Master Bookbinders of America.	Oct. 22-Nov. 21, 1923.
Do.	Wilson Normal School	Dec. 5, 1923-Jan. 21, 1924.
Waterloo, Iowa.	Dairy Cattle Congress	Sept. 24-30, 1923.
West Kingston, R. I.	Washington County Agricultural Society	Sept. 11-14, 1923.
Wilmington, Del.	Delaware State Fair	Aug. 27-31, 1923.
Worcester, Mass.	Massachusetts Department of Agriculture	Jan. 15-18, 1924.
Yakima, Wash.	Washington State Fair	Sept. 17-22, 1923.

<sup>1</sup> Exhibits made by Forest Service districts in West and reported to Washington.<sup>2</sup> These fairs had two separate exhibits.

### AGRICULTURAL INSTRUCTION IN SCHOOLS<sup>2</sup>

Since the organization of the Agricultural Instruction Section in 1906, the aim has been to encourage and stimulate the teaching of agriculture in secondary and elementary schools where facilities were available for carrying on such work. No attempt has been made to organize and administer instruction in agriculture in the schools, the service rendered being more of a cooperative nature. Since the passage of the Smith-Hughes Vocational Education Act the administration and supervision of agricultural work in the secondary schools has been under the direction of the Federal Board for Vocational Education in cooperation with the State boards of education in the several States. The Federal Government does not supervise the teaching of agriculture in elementary rural schools.

The work of the office has been directed in recent years primarily (1) to the making of studies of methods of teaching and the content of subject matter for use of teachers of agriculture in secondary and elementary schools and (2) to making available to both teachers and students of agriculture useful agricultural information accumulated by the Department of Agriculture and the State agricultural colleges and experiment stations. The office work of the staff has been confined more particularly during the year to the preparation of subject-matter material in form which can be used immediately by teachers in both secondary and elementary schools; to aid teachers in obtaining publications of the department classified by this service for their use; to loan lantern slides; and to suggest sources of other available illustrative material.

When the vocational educational work in the schools was formally established in 1918, 609 schools began teaching vocational agriculture under this plan with 895 teachers and 15,453 pupils. In 1923 there were 2,673 schools with 3,012 teachers and 71,298 pupils pursuing agricultural courses. The amount of Federal grant for vocational agricultural education has increased from \$547,027.79 in 1918 to

\$2,036,502.12 in 1924. The gradual increase from year to year in the number of schools teaching agriculture and the number of students taking the course are splendid evidences of the extent to which this type of education is being approved by the general public. As a result of the rapid growth of this movement there has been an increase in the number of requests for the department's material useful to teachers and students. As teachers of agriculture in the secondary schools are graduates of agricultural colleges where professional training courses are required, they are looking for the latest scientific facts and the most up-to-date methods used in teaching agriculture. It has been the aim of this service to keep the teachers in touch with helpful suggestions and information along these lines and to make studies and prepare publications especially for their use.

The teachers of agriculture in the rural elementary schools have not, as a rule, been as well trained for service as the teachers in the secondary schools. This service is making special efforts to reach this class of teachers by preparing simple lesson outlines for their use and by supplying them with leaflets telling how teachers may use Farmers' Bulletins. Various sources of illustrative material and publications are sent these teachers from time to time. While many of the teachers of the rural elementary schools have had some training in agriculture, and there are some examples of splendid work being done, the great majority have had no training along this particular line. The States, moreover, are interested in having some of the simple agricultural principles and practices taught in the upper grades of the better type of rural schools. A recent study of this question revealed that 32 of the 48 States had enacted specific legislation designed to procure for rural schools that type of education especially adapted to rural needs, emphasizing agriculture, economic nature study, the farm home, etc. The same study showed that 28 States require that agriculture be taught as a part of the regular school course. A limited number of States merely require that teachers be examined in agriculture as in other subjects. In a few instances funds have been appropriated for encouraging the teaching of agriculture in rural schools with the hope that agriculture may be thoroughly studied and taught by op-

<sup>2</sup> The Agricultural Instruction Section has been continued under the supervision of E. H. Shinn, with general direction by Dr. A. C. True. The annual report of this unit is printed with that of the Extension Service rather than separately, as a matter of convenience and economy.



servation, practical demonstrations, and the use of textbooks and other publications.

By means of cooperation with specialists of the different bureaus of the department up-to-date suggestions and material are procured and made available for agricultural teachers throughout the United States. In work of this character a service is being rendered which is not being duplicated by any other agency of the Government.

Cooperation has been continued during the year with the following agencies outside the Department of Agriculture: (1) With States which desire to have prepared courses of study in elementary agriculture for rural schools, (2) with the Federal Board for Vocational Education in making studies in the analysis of farm enterprises and in preparing publications for the use of agricultural teachers, (3) with heads of teacher-training divisions by furnishing them with lantern slides and sources of other material and by giving suggestions on analysis of farm enterprises for the teaching curricula, and (4) with teachers in service by supplying them with results of studies in agricultural education, copies of publications, lantern slides, and classified lists of material prepared especially for their use.

In cooperation with the States in the preparation of courses of study in elementary agriculture for rural schools at the request of State departments of education, the office has cooperated with the departments of education and the agricultural colleges of Virginia, Maryland, North Carolina, Ohio, Wisconsin, Arkansas, Oklahoma, Missouri, and Utah. The courses of study for Utah and Oklahoma have been practically completed during the year, and the one for the Missouri schools is now in the process of preparation. In the preparation of these courses, close cooperative relationship is maintained with the colleges of agriculture, officials of the State departments of education, and teachers of agriculture in normal schools and teachers' colleges. During the year conferences were held with representatives of the college of agriculture and the department of education and with agricultural teachers in Utah, Oklahoma, and Missouri with reference to the method and agricultural content of the courses being prepared for those States.

Immediately following the passage of the vocational education act in 1917

there was established between the Federal Board for Vocational Education and the United States Department of Agriculture through the Office of Agricultural Instruction a cooperative relationship which has enabled the agricultural-instruction staff of the department to keep in close touch with the vocational-education movement under the Smith-Hughes Act, and to render a service for the department to vocational education in agriculture by means of eight different studies, the results of which were published by the Federal board and are being extensively used by teachers of agriculture in the secondary schools. Two of the studies were courses in crop and animal production prepared especially for agricultural teachers in negro schools, and the remainder dealt more particularly with detailed job analyses of certain farm enterprises, such as the production of swine, poultry, potatoes, corn, truck crops, etc. In the preparation of each of these studies the manuscripts were submitted to the subject-matter men of the Department of Agriculture for criticisms and suggestions before being published. The object of these research studies is to analyze the job-unit operations in agricultural production and distribution in order to show the practical skill as well as the technical and scientific knowledge needed by those who want to develop competency in farming as a business.

Members of the staff have attended annual regional and State conferences of supervisors and teachers of vocational agriculture called by regional agents of the Federal board and State officials, and have appeared on the programs. Frequent conferences are held with regional agents and the chief of the Agricultural Education Service of the Federal Board for Vocational Education regarding the latest and best procedure in developing courses of study in vocational agriculture. The office was represented at the National Society for Vocational Education and the Rural Division of the National Education Association, where two members of the staff appeared on the programs.

The cooperation maintained with teacher-training divisions of the land-grant colleges has been in the nature of supplying lantern slides prepared especially for the use of agricultural teachers, publications of the department classified by this office for the use of teachers, and suggestions as to publications and sources of various other material useful to teachers.

Visits have been made during the year to a large number of teacher-training divisions and to individual schools where vocational work is carried on. Requests have come from teacher-training divisions for criticisms and suggestions on analyses and studies of enterprises as the basis of the teacher-training program. By means of visits to vocational schools many opportunities are offered to obtain first-hand information as to the progress of the work and new ideas are acquired with reference to ways by which better service can be rendered. It is evident that the agricultural teachers throughout the country regard the Department of Agriculture as the source of much useful information, and numerous requests are received in this office for various kinds of available information.

In our cooperation with teachers in service the aim has been to meet, so far as possible, the needs of teachers who are now engaged in teaching. The publications prepared in cooperation with the Federal board have served to guide many teachers of the secondary schools in the organization and presentation of their teaching material. Teachers of agriculture in the rural elementary schools have been supplied with publications of the office in simple lesson outline form. Leaflets offering suggestions to teachers regarding the use of certain farmers' bulletins have been distributed to large numbers of teachers. Lists of various kinds of material have been sent to the two groups of teachers. These teachers are supplied with those publications of the department believed to be best adapted to their needs.

There has been a great demand during the year for illustrative material in the form of lantern slides. This service receives numerous requests for lantern slides from individual teachers

and from agricultural colleges where circuits have been formed for the distribution of slides within the States. The distribution of slides has been extensive, in many instances the requests being greater than the supply. The older series of slides are being revised from time to time and new series are being prepared. During the year attention has been given to the preparation of two series of slides for agricultural teachers dealing with the swine and poultry enterprises.

Cooperation with the Association of Land-Grant Colleges was continued through its committee on instruction in agriculture, home economics, and mechanic arts. The committee made its report at the annual meeting of the association in 1923 on the following topics: (1) Means of adapting instruction and rate of progress to the ability of students, with particular reference to the stimulation of scholarship; (2) status of vocational courses in agriculture in high schools operated under the Smith-Hughes Act; and (3) the relation of the land-grant colleges to rural-school improvement.

In cooperation with the above committee a member of the staff visited during the present year a large number of the State agricultural colleges to confer with presidents and deans in connection with a study being made by the committee with reference to (1) methods of conducting examinations in land-grant colleges and (2) the aim, character, and duration of short courses as they are now conducted in the land-grant colleges.

The work of the office has remained under the general supervision of Dr. A. C. True, formerly director of the States Relations Service. His able counsel and suggestions have been sought and followed on all important matters pertaining to the work of the office.







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DEPARTMENT STATE

## REPORT OF THE FEDERAL HORTICULTURAL BOARD

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
FEDERAL HORTICULTURAL BOARD,  
*Washington, D. C., October 1, 1924.*

SIR: I submit herewith an executive report covering the administration of the plant quarantine act for the fiscal year ended June 30, 1924.

Respectfully,

C. L. MARLATT,  
*Chairman of Board.*

HON. HENRY C. WALLACE,  
*Secretary of Agriculture.*

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### INTRODUCTION

This review covers only the more important activities of the Federal Horticultural Board in the enforcement of the plant quarantine act. A much more detailed record of the work under this act, including the full text of all quarantines and regulations issued, together with explanatory press and other statements, is given in the Service and Regulatory Announcements of the board, published quarterly.

The growth of the work of the board has necessitated a reorganization of the various offices concerned in the enforcement of foreign plant quarantines.

E. R. Sasser, formerly in charge of the Plant Quarantine Inspection Service, has been assigned to the position of entomologist and executive officer. Under this assignment he becomes the immediate representative of the board and will cooperate with the chairman and other members of the board in the general administration of the plant quarantine act. In addition, he will continue, as hitherto, the direction of the Mexican border work.

The plant quarantine inspection service, which is charged with the enforcement of plant quarantines at ports of entry, including customs post offices for parcel post importations of plant material, and with the inspection and safeguarding of all special permit material and of departmental and other importations, has been placed in charge of Lee A. Strong, formerly chief of the Bureau of Plant Quarantine of

the State of California. Mr. Strong's long experience in quarantine work in California has peculiarly fitted him for this post.

The Section of Foreign Plant Quarantine Service remains, as hitherto, under the charge of R. Kent Beattie. This service is responsible for the issuance of permits and licenses concerned in the entry and subsequent utilization of restricted plants and plant products, enforces the required safeguards with respect to such utilization, and conducts all correspondence relative to these duties.

No changes have been made in the administration of the domestic plant quarantines. The board, under special appropriations, enforces the pink-bollworm quarantine and directs the control and eradication work with respect to this pest. The same is true of the date scale quarantine and eradication effort and of the potato wart control work. Quarantines on account of the white-pine blister rust and the black stem rust are being administered in cooperation with the Bureau of Plant Industry under special appropriations assigned to that bureau. Similarly, the quarantines on account of the European corn borer, gipsy moth, brown-tail moth, satin moth, Japanese beetle, Mediterranean fruit fly, and melon fly are being administered in cooperation with the Bureau of Entomology under special appropriations assigned to that bureau. Other minor domestic quarantines are being administered directly by the board.

## THE PINK BOLLWORM

### STATUS OF ERADICATION EFFORT

No areas of new infestation by the pink bollworm have been determined during the last two years, and, except in the western districts of Texas and in New Mexico, no reinfestation has developed in any of the territory where the insect had been previously established. The more important areas originally infested in central and in eastern Texas and in Louisiana are now (October 1, 1924) apparently free from this pest and such freedom has continued for three or more years. The effort to eradicate the pink bollworm at least in the principal cotton areas where it obtained a foothold, appears therefore to have been successful. The accompanying table indicates for the principal districts in central and eastern Texas and in Louisiana the time that has elapsed since the last infestation was found and the amount of field scouting since that time given to each district without the uncovering of infestation.

#### *Freedom of infestation in central and eastern Texas and in Louisiana*

District	Time elapsed since last infestation was found		Number of man-days of scouting since last infestation was found
	Years	Months	
Hearne, Tex.....	7	-----	2,430
Trinity Bay, Tex.....	3	-----	2,981
Cameron, La.....	4	7	1,270
Shreveport, La.....	3	9	1,303
Marilee, Tex.....	2	10	1,464
Ennis, Tex.....	2	10	1,523

In western Texas and in New Mexico no continued effort has been made to eradicate the pink bollworm, for the reason that in the border areas in these States reinfestation is almost certain. In the cotton-growing districts in the upper Pecos Valley in these States there has been very effective climatic control—most of the larvæ not surviving the winters. The danger of infestation spreading from these western areas eastward is, however, being controlled by quarantine, by the installation of seed disinfection machines in all gins, and by the separation of these areas from central and eastern Texas. It is not believed that the risk of spread from these areas of infestation is greater than that from the infested areas in Mexico.

While the work of eradicating this pest is now in this very satisfactory condition, it would be too much to expect that there will be no recurrences of infestation in some of the areas where eradication has been undertaken, and it is also possible that new centers of infestation may at any time result from direct carriage from Mexico. The control of any such future outbreaks is, however, reasonably assured by what has already been accomplished, but as pointed out last year, there should be no relaxation in the survey and control work. Intensive field scouting must be continued and funds must be available for immediate clean-up and other repressive measures if the results which have been secured are to be retained.

### INFESTATION IN WESTERN TEXAS

With respect to the crop of 1923, as the result of intensive scouting, continued into 1924, infestations were found in but three localities, all in western Texas. One infested field was determined in the El Paso district, 5 in the Pecos district, and 33 in the Big Bend of the Rio Grande. Except in the latter district, the number of specimens found was comparatively small, namely, 29 in the El Paso district, and 14 in the Pecos district.

### RISK OF SPREAD FROM THE WESTERN AREAS OF INFESTATION

While the measures of control already indicated have eliminated much of the risk of spread from the known infested areas in western Texas, it must be recognized that this risk remains as long as any such areas are infested. There has been no infestation in the Carlsbad area (Pecos Valley) in New Mexico now for two years, as determined by thoroughgoing scouting carried on each year, totaling upward of a thousand man-days, and the infestation in the Pecos areas in western Texas is almost negligible, due both to climatic control and to the measures which are being enforced. The infestation in the Big Bend district, however, is steadily growing, and the risk is further increased by the larger acreage devoted to cotton.

The continued occurrence of this pest in western Texas has necessitated the supplementing for that district of the quarantine measures hitherto enforced by provision for inspection of all automobile traffic leaving the Big Bend, El Paso, and other districts. Such inspection has resulted in the interception of a good deal of cotton, some of it containing living pink bollworms. Some of this



cotton has been in the form of cotton bolls or cotton plants taken away as souvenirs, but more important is the occasional carriage of small quantities of cottonseed—in one instance by a tourist en route from El Paso to California—and the frequent movement by laborers of cotton-picking sacks and of bedding and other articles which contain cotton with cottonseed. In cooperation with the States concerned, six traffic inspection stations are now in operation to safeguard such road movement.

#### PINK-BOLLWORM SCOUTING

As already indicated, the scouting to determine the presence of the pink bollworm throughout the areas which have shown infestation at any time and with respect to the whole Mexican border from El Paso eastward is work which must be continued actively and effectively if future establishments of this pest are to be caught up in time to result in the prevention of spread possibly beyond control by eradication. The cost of this work is a very small insurance to pay for the elimination of what is believed to be the most important of all cotton pests. During the year such scouting work was considerably increased, particularly throughout the more effective season for such work, from September 1 to March 1. This increase for the season of 1923 amounted to some 23 per cent over that of 1922, the total number of man-days devoted to such work being 9,588 as against 7,760. The actual value of this increase is, however, not fully indicated by these figures because of the fact that this work was, for 1923-24, more largely centered in the effective period indicated—in other words, the period when practically all the findings of infestation in former years have been made. On this basis there was an increase of effectiveness of man-day work of approximately 75 per cent over the year 1922-23.

As in previous years, inspections were continued in portions of Mexico contiguous to the United States, special attention being devoted to the territory from San Carlos, opposite Del Rio, to the mouth of the Rio Grande. Any infestation in this district would immediately jeopardize the plantings in Texas. No infestations were found even in the San Carlos region, where the insect was discovered several years ago. Its disappearance seems to be due in a considerable extent to the abandonment of cotton and to clean-up measures where cotton cultivation has continued.

#### CLEAN-UP OF COTTON FIELDS

Undoubtedly the cleaning of the fields has been a very important factor in eliminating the infestation in the six districts in Texas, Louisiana, and New Mexico where eradication seems to have been accomplished. As an extreme precautionary measure such clean-up work was continued during the winter of 1923-24 in the Ellis, Marilee, and Shreveport districts. Altogether 19,850 acres were cleaned at an average cost of \$1.82 per acre.

Since the inauguration of the work in 1917, 72,892 acres of cotton land have been cleaned at a total cost of \$432,168.48.

Under the cultural and labor conditions in the South no clean-up work can be made 100 per cent efficient, and the effectiveness of clean-up measures as conducted finds a possible explanation in the results of certain investigations made in Mexico, which indicate that moisture is very destructive to the hibernating larvæ. It was found that the greatest survival was in bolls on the plants. Bolls on the surface of the ground produced fewer insects, while bolls beneath the surface which were kept moist failed to develop any of the insects. The clean-up measures practiced in this country have disposed of practically all of the insects on the plants or on the surface of the ground, and those that made their way into the soil very probably failed to survive on account of the moist conditions brought about by the normally heavy winter rains.

#### COTTONSEED DISINFECTION

Under State regulations, cottonseed heat disinfection machines have been installed at all gins in the quarantined districts and the heating of the seed has become a part of the ginning process. These machines are provided with automatic recording devices, making it possible to readily detect and immediately remedy any failure to maintain the required temperature in the process of disinfection. During the year, 81 of these machines were in operation and approximately 75,000 tons of seed were disinfected.

The cost of treating seed has been found to range around 20 cents per ton. The treatment does not injure the vitality of the seed, increases its keeping qualities, and results in a somewhat better grade of oil.

#### REVISION OF REGULATIONS

As the work progressed, it has been possible to modify some of the re-

strictions of the quarantine, especially with reference to lint. On October 15, 1923, an amendment was promulgated under which the shipment of lint and linters grown in regulated areas to points in Canada was permitted. The amendment of January 17, 1924, makes provision for the interstate movement of seed cotton from one regulated area to another under such safeguards as might be required.

An additional amendment, effective April 5, 1924, releases certain counties in New Mexico from any restrictions as regards lint. These counties were originally placed under quarantine pending a thorough investigation to determine their freedom from the pink bollworm, and such freedom seemed to have been fully established. This amendment further provides for the movement of seed cotton from the eastern counties of New Mexico to points in Texas, provided it is ginned in establishments equipped with disinfecting machines. It also allows the interstate movement without permit of baled cotton lint and linters grown in regulated areas in which no infestation had been found for a period of two years or more, provided all gins operating in such areas are equipped with approved disinfecting machines and that all cottonseed passing through such gins is disinfected in a prescribed manner.

#### VACUUM FUMIGATION PLANT AT EL PASO

Authority was granted for the construction of a vacuum fumigating plant at El Paso for the disinfection of locally produced cotton. Such cotton, produced in regulated areas in Texas or New Mexico, when fumigated under the supervision of the department, will be allowed to move without restriction. It is believed that the erection and operation of the plant will reduce the danger connected with the shipment of lint from the infested territory and will remove important marketing difficulties.

#### RESEARCH IN MEXICO

The investigation of the pink bollworm in Mexico as a basis for control measures has been continued. Additional information has been obtained indicating that a method of controlling the insect by the use of poisons is within the range of possibilities. Poisons used for the boll weevil, however, are not effective. This research work has also taken into account the relative susceptibility of cotton of different strains and the effect that methods of tillage and irrigation have on the insect. The results of these investigations up to the

end of last season are in the course of publication.

#### MEXICAN BORDER CONTROL

To prevent the further entry of this pest from Mexico, for several years all commercial and other Mexican border traffic into the United States has been safeguarded by inspection and disinfection. Briefly, this work consists in the inspection, certification, or, if necessary, fumigation of cars as a condition of entry into the United States. It has also included the examination of plant products, largely fruits and vegetables, entered under permit for local consumption, and footbridge or line inspection of baggage and personal effects, both being carried out in cooperation with the customs service.

During the period under review, 29,320 freight cars were inspected on the Mexican side of the border, 2,876 of which were contaminated with seed. As a condition of entry, 16,700 were fumigated, for which fees amounting to \$67,724 were collected and turned into the Treasury as miscellaneous receipts.

At Del Rio, Tex., where there are no railroad facilities into Mexico, 19,410 vehicles of various descriptions were examined and safeguarded as to vehicle and contents.

In the fumigation of cars, etc., and freight considerable saving was effected by the installation of air compressors. By the use of these compressors it has been possible to reduce the dosage necessary to secure satisfactory results, with a consequent saving of approximately \$10,000 annually in the cost of chemicals. Experiments have also been conducted with liquid hydrocyanic-acid gas and it now appears that this liquid can be used advantageously in connection with the border fumigation work.

The inspection of baggage and personal effects in cooperation with the customs service has resulted in a number of important interceptions, including the Mexican fruit fly in several hosts, two injurious avocado weevils, the pink bollworm in cottonseed, and a number of others of less importance. In this inspection large quantities of contraband fruits, plants, etc., have been taken from passengers and pedestrians.

To expedite the movement of cotton samples originating in Mexico and forwarded through the mails, arrangements have been made with the U. S. Postal Service to divert all samples arriving at ports on the border to Laredo for fumigation before they are permitted to go to the consignee, and for such disinfection a special fumigation apparatus has been provided by the board.



**EUROPEAN CORN-BORER QUARANTINE  
(DOMESTIC)**

The quarantine (No. 43) on account of the European corn borer was revised effective May 1, 1924. This revision adds the State of Vermont for the purpose of including two infested townships in that State, and incorporates additional territory determined as infested in the States of Maine, Massachusetts, and Ohio. Upon the recommendation of experts of the Bureau of Entomology, spinach was eliminated from the articles enumerated as brought under the regulations, due to the fact that it is shipped for the most part north and east of Boston, thus doing away with what is believed to be unnecessary inspection.

This quarantine is enforced in cooperation with the Bureau of Entomology of the department, which, under a special appropriation, administers the quarantine, and also in cooperation with the States concerned under supporting State quarantines. The purpose of this quarantine is to prevent long distance spread through the movement of such carrying products as corn and other crops in which the insect breeds. In the main such control has been successful during the year and the spread from the important areas now infested has been limited to such local spread as is occasioned by the natural flight and movement of the insect itself. The important exceptions to such local spread are certain outbreaks along the southern shore of Rhode Island and Connecticut, including Nantucket and Marthas Vineyard, Mass., and in the southwesterly end of Long Island in the Borough of Brooklyn. Some of these points may have been due merely to natural spread, or to movement of products, from older near-by infestations, some of them of long standing, in Rhode Island and Massachusetts. Others, however, seem to have resulted from the movement through Long Island Sound of broomcorn from New York to Boston for disinfection, the necessity for which was fully gone into in my report of last year. The infestation in Brooklyn would seem undoubtedly to have resulted from such foreign broomcorn.

The points of infestation near New London, Conn., and in the outskirts of Brooklyn have been cleaned up as thoroughly as possible, either by State forces as to Connecticut or by Federal forces in cooperation with State forces as to the Brooklyn area and it is believed that such clean-up has been sufficient to very largely eliminate the risk of spread from these areas.

It is fully admitted that the natural spread of the corn borer must continue gradually, and, in spite of all efforts, from time to time through movement of infested products by longer jumps. It is still believed, however, that quarantine measures safeguarding such movement of products are warranted as a valid insurance against the losses which this insect may occasion should these efforts be discontinued, with the resulting rapid spread which would certainly follow westward and southward into the important truck regions and into the main corn belt. A fuller statement with regard to the work for the control of this pest will be found in the report of the Bureau of Entomology.

**EUROPEAN CORN-BORER QUARANTINE  
(FOREIGN)**

This quarantine (No. 41) applies not only to the European corn borer, but also to other dangerous insects as well as plant diseases known to affect corn in various foreign countries and not now widely prevalent or distributed within the United States. It covers, in addition to ordinary Indian corn and broomcorn, many other plants more or less closely related to corn and subject to the same pests and diseases. The regulations under this quarantine release certain articles from restriction, including sorghum hay from Canada and clean shelled or threshed grain from any country except as to certain grains or seeds restricted by other quarantines. They also provide, under restrictions and safeguards, for the entry of broomcorn for manufacturing purposes.

During the year the regulations with respect to the entry of broomcorn have been twice amended to still further safeguard the entry of this product. The first amendment, effective September 1, 1923, provided for the entry of broomcorn at Boston throughout the year and limited its entry at New York to the period November 1 to February 28, inclusive. It further prohibited the bringing of broomcorn to New York for transshipment to Boston or other ports during the remainder of the year. The second amendment further limited the period during which broomcorn may enter New York from November 1 to January 31, inclusive. Provision was made also for more adequate baling of broomcorn to prevent leakage and limited the sterilization period to 30 days.

These amendments were necessitated on account of the frequent ar-



rival of foreign broomcorn showing heavy injury by the European corn borer. In some instances the infestation closely approached 100 per cent of the stalks. Permittees were requested to immediately notify foreign exporters of the situation and to advise them that continued shipment of heavily infested material would jeopardize the continuance of authorization of broomcorn importations.

To safeguard such entry, all imported broomcorn is given steam sterilization in vacuum retorts under conditions which have been demonstrated to thoroughly cook and kill any contained insect or other life. On account of the fact that the vicinity of Boston has been for many years infested with the European corn borer, the department seems to be warranted in permitting the entry of foreign broomcorn throughout the year at that port. The limitation of entry at New York to the three designated months is for the purpose of having all such entry and required disinfection fully completed prior to any possibility of activity on the part of any borers carried in the imported corn. In view of the general infestation of foreign broomcorn with this pest and the possibility of carriage also of other pests, it would seem to be highly desirable to so develop broomcorn culture in this country as to make further importations of foreign broomcorn unnecessary.

#### JAPANESE-BEETLE QUARANTINE

The continued spread of the Japanese beetle, involving considerable areas in New Jersey, and in Pennsylvania to the north and west of Philadelphia, made it necessary to extend the quarantine (No. 48) promulgated on account of this pest. As revised, the State of Delaware is included in the general quarantined area which had previously comprised only the States of New Jersey and Pennsylvania. Such extension was necessary in order to give an adequate safety zone beyond the known spread, which had already reached the border of Delaware. As hitherto, this quarantine is being enforced in the States concerned only as to the areas actually designated as infested or, as to safety zones, immediately threatened with infestation, and does not affect movement of products elsewhere in the State, conditioned, however, on cooperation under State quarantine to prevent movement from areas designated as above to other portions of the State.

In the case of Delaware, only one township is now involved, and that merely as a portion of the safety zone.<sup>1</sup>

In connection with the revision of the quarantine certain changes were made in the regulations, having to do with definitions and particularly with relation to the control of the movement of farm products, nursery and ornamental stock, and sand, soil, earth, peat, compost, and manure.

As in the case of the European corn borer, the purpose of this quarantine is to prevent long-distance spread of the beetle in connection with the movement of various farm and truck crops and of fruits and florist and ornamental stock; in other words, to hold its spread as closely as possible to the unpreventable local movement of the insect itself. Its natural spread by flight from 5 to 10 miles a year is beyond control other than by such measures as may reduce the abundance of the pest itself in the invaded areas either by artificial means or by the agency of natural enemies. The continuation of such quarantine measures and the assumption of the costs involved will be warranted only so long as the actual spread of the pest is materially delayed by the restrictions on movement which it is practicable to enforce. Undoubtedly, except for such restrictions as have been enforced for the last several years, this pest would now be widely distributed throughout the United States. The control of movement of carrying products is rendered very difficult in the metropolitan area now invaded by this pest by reason of the great volume of farm products moved by truck and automobile. It is, therefore, necessary not only to control the movement by rail and other common carriers, but also to police the main roadways for the purpose of enforcing the provisions of the quarantine with respect to truck and other road traffic. In all of this quarantine work the States concerned are cooperating.

As has been previously pointed out, this pest is recognized as one of the worst of the later introductions of foreign crop enemies, particularly on account of the wide range of crops and ornamental plants which it attacks either in the grub stage or as an adult beetle. The main hope for the future is in natural enemies or possibly by methods of artificial control which will prove more effective than any which have so far been devised.

<sup>1</sup>Subsequent to July 1, 1924, an infestation was determined in this township.

## GYPSY MOTH AND BROWN-TAIL MOTH QUARANTINE

The amendment of August 21, 1923, of the domestic quarantine on account of the gipsy moth and brown-tail moth resulting from the conference with nurserymen and others in interest held in the Statehouse, Boston, Mass., August 17, 1923, is discussed in the annual report for that year (see pp. 7 and 8).

This quarantine was again revised June 12, 1924, effective July 1, to bring under control the additional areas reached by the gipsy and brown-tail moths as determined by the scouting in the fall, winter, and spring of 1923-24. The spread of the gipsy moth into western and northwestern Vermont made it necessary to include in what is designated as the lightly infested area all of the remaining portions of that State. The quarantine line already extended to the western border of Massachusetts. In western and southern Connecticut it was necessary to include some additional towns in the lightly infested area. The only change in the brown-tail moth area was the inclusion of Mount Desert Island, Me.

The regulations of the quarantine were amended providing for certain additional requirements relating to inspection and certification of nursery stock, substantially, however, as agreed upon at the Boston conference of August 17, 1923, but somewhat added to and modified by a supplemental conference held in Washington April 22, 1924. The important new factor is that certification of Christmas trees and greens for interstate movement under the quarantine will hereafter be limited to such products originating in the area designated as lightly infested.

At a conference of April 30, 1924, it was determined to establish and maintain, as the main feature in the future effort to prevent further spread westward of the gipsy moth, a barrier zone some 25 miles in width along the present western border of spread, i. e., between New England and New York. Within and beyond this zone an effort will be made to thoroughly clean up and eradicate any infestations or colonies. This zone plan was first discussed at an interstate conference which was held in Albany November 16, 1922. Such control plan is now deemed feasible, inasmuch as in the westward movement of this pest it has reached a region where the natural barriers and the character of the country give reasonable hope of keeping such

zone free from permanent infestation. The urgency for the adoption of the barrier-zone plan at this time is that should the gipsy moth get beyond this border strip into the Adirondack and Catskill regions of New York, its control in these districts would be extremely difficult, if not impossible, and its more or less rapid spread westward could probably not be prevented.

As noted in former reports, no quarantine has been promulgated to cover the areas of infestation by the gipsy moth in New Jersey and New York, since the eradication measures and other controls adopted by these States in cooperation with and under the supervision of experts of the Bureau of Entomology were deemed adequate. The area infested by this moth in New Jersey has been reduced one-half since the work was undertaken in that State, and the few points on the eastern border of New York have been, it is believed, thoroughly cleaned up.

Owing to the presence of the gipsy moth in northern Vermont near the Canadian border and the fact that it will undoubtedly invade the Dominion and from there spread to other parts of the United States, a foreign quarantine (No. 57) was promulgated effective July 1, 1924, which regulates the movement of Christmas trees, arbor vitæ, and decorative greens from certain portions of the Province of Quebec.<sup>2</sup>

## DATE-SCALE ERADICATION

The Parlatoria date-scale eradication work has been continued during the year with marked success along the lines indicated in the last annual report. All infested trees, as promptly as discovered, are now being cleaned up by the drastic process of burning to the bud. It will, however, be necessary to continue the tree-to-tree investigation for a series of years and to give the same drastic control treatment to any infested trees, to be assured of the ultimate eradication of this pest. As has been previously pointed out, the future of the date industry in this country seems to be conditioned on such eradication.

In connection with this control work, and in cooperation with the Bureau of Entomology, important biological studies have been made of both the Parlatoria and the *Phoenicococcus* or red

<sup>2</sup> Since this quarantine was promulgated the Canadian Department of Agriculture has reported the finding of gipsy-moth infestation in southern Quebec within the area covered by quarantine 57.



scale, the latter an important date pest, but very much less destructive than the Parlatoria. The experiments with the latter pest indicate possibilities also of ultimate eradication.

### POTATO WART

Local surveys have been maintained in the infested areas in Pennsylvania, West Virginia, and Maryland, and they have occasionally brought to light new infected gardens, but all of these have been within the present quarantine limits, i. e., no new infections outside the quarantined area have been reported. The three States named are enforcing the use of immune varieties as the principal control measure, and are maintaining effective quarantines against the dissemination of the disease.

### WHITE-PINE BLISTER RUST

The two domestic quarantines which have for their purpose the control of the white-pine blister rust have been enforced by the Bureau of Plant Industry in cooperation with the board, State officers, common carriers, and nurserymen. The known distribution in the eastern States of this disease is unchanged and in western United States it is apparently still confined to the State of Washington.

Much time has been devoted to railroad-terminal and post-office inspection for the purpose of intercepting unlawful shipments of white-pine blister-rust host plants. During the spring of 1924, 28 violators were detected, as compared with 188 for the similar period in 1921. This reduction in the infractions of the quarantines is the result of systematic enforcement of penalties and the excellent support and cooperation given by the nurserymen in making them effective.

The protection given the extensive forests of western white and sugar pine by the quarantines is further supplemented by the general eradication of the European black currant (*Ribes nigrum*) (often referred to as the cultivated black currant) by the Bureau of Plant Industry in cooperation with important pine-producing States. This plant is a distinct menace to the white-pine timber supply of this country, since it is an active agent in the long-distance spread and establishment of the white-pine blister rust. On this account it has been outlawed in certain States, and this department is on record as opposing its cultivation within the natural range of the five-needled pine.

### BLACK STEM RUST OF WHEAT

The campaign, under quarantine No. 38, to eradicate the common barberry for the purpose of controlling epidemics of black stem rust of wheat, which was undertaken in 1918 by the Bureau of Plant Industry in cooperation with State officials and others of the northern central grain-growing States, has been continued substantially along the lines indicated in the last annual report. During the year preliminary surveys were made in an area equivalent to 183 counties; and subsequent surveys, to determine whether bushes previously located had been removed, were made in 271 counties. Since 1918, approximately 668 counties have been surveyed and some 10,000,000 bushes, seedlings, and sprouting plants have been located, most of which have been, or will shortly be, destroyed. The eradication of barberries is well under way, being about two-thirds completed.

### IMPETUS GIVEN TO AMERICAN HORTICULTURE BY QUARANTINE 37

While quarantine 37 has the sole purpose of reducing to the utmost the risk of introducing dangerous plant pests with plant importations, it is true that it has given an enormous impetus to American horticulture and floriculture. Some 2,000 establishments in 44 of the 48 States are now engaged in the propagation of ornamental and other plants formerly imported, and this new development already represents many millions of invested capital. The table given on page 20 shows for the 5-year period of the quarantine—1919 to 1924—the distribution by States of the special-permit material, the entry of which is provided for under the quarantine for propagation or seed stock. It is very gratifying that this large development has followed the quarantine rather than the injury to the horticulture and floriculture of this country, which was widely predicted at the outset. Along with this new development, based on imported stock, has come an enormous increase in the production of ornamentals in this country, based on propagating materials available here, and this latter increase probably exceeds many times that based on imported stock. The bearing of all this development on the purpose of quarantine 37 is that it lessens the necessity for future importations and correspondingly reduces the risk of bringing in new pests. The present status of this development,



based on imported material only, is indicated in the following analysis submitted by R. Kent Beattie, pathologist of the board, in charge of foreign plant quarantines, in which office falls the enforcement of quarantine 37:

Plant material imported during the last 5 years by special permit under regulation 14 of quarantine 37 is the basis of plant propagation enterprises in 44 of the 48 States.

During the 5 years of the quarantine the production in America of varieties of gladiolus, dahlia, and rhizomatous iris is practically stabilized. Of many gladiolus varieties there is almost an oversupply. Dahlia production at least equals and perhaps exceeds that in foreign countries. Rhizomatous iris covers hundreds of acres.

Outdoor rose production is on its feet. The rapidity with which a few imported roses may be multiplied into many plants and the use of the large quantity of available domestic propagating stock has expanded rose growing to an enormous acreage.

Over a quarter of a million imported peonies are being propagated. Since peony stocks are somewhat slow in their development and the commercial demand is on the increase, there are some varieties not yet sufficiently available.

While bulbous iris production is still in the developmental stage, about 10,000,000 imported bulbs are in the hands of 161 different growers in 31 States. Unfavorable weather conditions this year have interfered somewhat with the progress of this industry.

Azalea and rhododendron production is making headway, but the commercial demand is by no means satisfied. Several growers can count their home-produced azaleas by the hundred thousands.

Many acres are now devoted to the raising of ornamental shrubs and trees. The production of the more difficult kinds is coming on slowly. American nurserymen are learning to plan for the future, to hold mother stock plants, to grow their own seedlings, to collect their own seeds, and to locate in advance American supplies. As a whole, the business is expanding rapidly.

Of all classes of plants the development of an American orchid supply is the slowest. This is due to the cost of the parent orchid plants, the expense of maintaining orchid houses, the difficulty of germinating orchid seed, the long time necessary for the growth of an orchid plant, and the reluctance of many orchid growers to give up dependence upon wild orchids; but the last two years have seen rapid development. More than 60 American growers are multiplying imported plants by back-bulb production and at least 6 have successfully undertaken seedling production on an extended scale. These now have about 400,000 seedlings 18 months or more old and perhaps 10,000 to 12,000 of these will bloom this year. The development in the United States of Knudson's sugar culture method of germinating orchid seeds apparently will give a great impetus to the industry. Orchid seeds are also being germinated on a commercial scale in the United States by planting near chopped orchid roots and by growing in pure culture with the orchid fungus.

### COTTON AND COTTON-PRODUCTS QUARANTINE

Under the order issued April 27, 1915, all raw cotton in any form, including also cotton wrappings, was brought under inspection and certification and safeguarding as a condition of entry. This was for the purpose of excluding the pink bollworm of cotton and other cotton pests. The regulations governing such inspection and certification have been amended

several times. The last of these amendments was issued under date of April 30, 1924, and had for its object the release from the requirement of disinfection of certain classes of cotton and cotton products which have been so manufactured or processed as to have eliminated all insect life, irrespective of the nature of the wrappings covering such products. After several years' experience, the board believes the requirement of disinfection, merely on account of the use as wrappings for such products which may have been previously employed as coverings for cotton lint, etc., to be unnecessary and this requirement was therefore withdrawn. It is now believed that any possible risk which may remain can be safeguarded in the course of inspection, as a condition of entry, given by the agents of the board to the wrappings of all such materials.

The statistics of entry of cotton lint and other restricted articles under the provisions of the order referred to have been given from year to year. The total number of bales of lint entered during the fiscal year 1923-24 is 408,868, being the third largest yearly entry of cotton lint since the order was promulgated. For comparative purposes, there is listed below the importations for the past nine years in the order of the quantities imported:

Year	Bales	Year	Bales
1919-20	595,765	1920-21	221,303
1922-23	481,396	1916-17	216,337
1923-24	408,868	1917-18	195,723
1921-22	386,303	1918-19	179,537
1915-16	316,260		

If to the entry of cotton lint during the fiscal year 1924 is added the importations of cotton waste and bagging, a total of 562,520 bales is indicated—the third largest annual combined entry of these commodities since they were placed under restriction. The maximum figure of such importations was in the year 1922-23, when the bale imports for these three commodities reached the total of 825,438.

All bales of cotton and cotton products requiring disinfection as a condition of entry were fumigated at the authorized entry ports of Boston, New York, San Francisco, Seattle, and Portland, Oreg., in disinfection plants under private ownership but operated under the supervision of Federal inspectors. For tables indicating respectively the importations of cotton, cotton waste, bagging and cottonseed, seed cotton and cottonseed products, see pages 21-23.

### FRUIT AND VEGETABLE QUARANTINE

The promulgation in 1923 of quarantine 56, restricting the entry into the United States of all fruits and vegetables, was discussed in last year's report. (See pp. 16 and 17.) This quarantine, which became effective November 1, 1923, was amended October 23 of that year to make provision for the entry of certain hot-house-grown fruits and other specialties which can be accepted as free from risk of carrying injurious insects, including fruit flies. Under this amendment entry has been authorized of the following fruits: (1) Hothouse-grown grapes, when they can from place of origin and manner of growth be considered as absolutely free from risk; (2) sour oranges from Spain imported for marmalade manufacturing, with entry limited to northern ports and for use in northern factories under full control, the process including prompt cooking of the fruits and the burning of all waste, including packing material and crates; (3) avocados from the West Indies and the United States of Colombia; and (4) *Citrus medica* from Palestine for use in connection with religious ceremonials. As will be noted elsewhere, a series of surveys has been made of the avocado in the West Indies which indicated complete freedom of this fruit from fly attack. A similar survey of the United States of Colombia has indicated a corresponding safety of Colombian avocados. The entry of all such fruit, however, is further safeguarded under permit by limiting it to certain ports of entry and providing for thorough inspection.

The administration of this quarantine, involving the control under permit and inspection at port of arrival of all imports of fruits and vegetables, has added very much to the port inspection work of the board, and has necessitated a considerable increase in the inspection force. In the course of this work a great deal of contraband material has been intercepted and excluded, and a new and very serious risk from Spanish grapes has been determined. For a record of the fruits and vegetables imported under this quarantine see tables on pages 24-28.

#### THE ALMERIA GRAPE SITUATION

In the course of inspecting fruits and vegetables entered at the port of New York under quarantine 56, it was discovered in the latter part of November, 1923, that the so-called Malaga grape from the district of Almeria, Spain, was sparsely infested with maggots of the Mediterranean fruit fly. No suspicion had hitherto been entertained that this

grape is attacked by the Mediterranean fruit fly. A general conference was called November 27, 1923, including the importers and handlers of such grapes, to consider this new danger, and as a result of this conference it was determined to exclude all "lines" of grapes in which any infestation was found and to require their exportation, and to permit entry of "lines" in which no infestation was found. Such action seemed to be justified by the fact that the majority of the crop had already been imported and distributed, and the balance of the crop was either already at dock awaiting entry or en route. The term "line" covered grapes originating in a particular vineyard. The persons in interest promised not to ship any infested lines to Cuba or other West Indian Islands.

It should be noted that the infestation of these grapes has been very slight; so slight, in fact, that the original determination might not have been made except for the unusual expertness and skill of the department's inspectors. For the most part the grapes showed no exterior sign of attack. In fact, as a rule the infested berries were superior in appearance and would normally be eaten without suspicion by anyone. While as a rule only single berries were found infested, in one instance 29 larvæ were taken from a single bunch of grapes. In spite of this sparseness of attack, the records of the actual findings in what was necessarily a more or less cursory examination of only 1 barrel in 15 of each "line," made it clear that the importations of the year must have brought into the United States many thousands of larvæ. It was further evident that the manner of storage and holding of these grapes and the ground cork in which they are packed offered unusually favorable conditions for the overwintering of the larvæ either in the grapes or after they had passed from the grapes to the cork dust for transformation.

On January 4, 1924, a second grape conference was called for the purpose of determining the future policy of restrictions on the entry of Almeria grapes. Following this conference the decision was reached that as a necessary measure of protection to the fruit and vegetable crops of the United States it was advisable to prohibit further entry of Almeria grapes.

To provide for such prohibition and for any like control as to other countries or districts which may later be necessary with respect to imports of grapes, the rules and regulations supplemental to Notice of Quarantine 56, governing the importation of fruits and



vegetables into the United States, were amended, effective January 18, 1924, to provide that grapes of the European or Vinifera type may be imported only upon the presentation of evidence satisfactory to the United States Department of Agriculture that such grapes are not attacked in the country of origin by injurious insects, including fruit flies.

(For a fully informing report on the Almeria grape situation see S. R. A. Nos. 77, 78, and 79, 1923-24.)

### EXPLORATION AND RESEARCH WORK

Certain exploration and research work is conducted by the board in cooperation with the appropriate research bureaus of the department when the information to be obtained is immediately necessary with respect to quarantines which the board is enforcing or quarantine subjects which are before the board for determination. Some of this work has been more or less of a continuing nature, such as the studies of the pink bollworm of cotton in the Laguna, Mexico, and certain research work in connection with the date-scale quarantine. In both of these fields of exploration and research, very important information has been obtained during the year, which will be set forth in reports issued in cooperation with the board and the bureaus concerned.

#### FRUIT-FLY SURVEYS IN MEXICO, CENTRAL AMERICA, COLOMBIA, AND CUBA

For the purpose of securing information necessary for the adequate enforcement of the fruit and vegetable quarantine (No. 56) field surveys were undertaken in the latter part of the year 1923, with respect to Mexico and the Central American States and the United States of Colombia by Dr. William M. Mann, and with respect to Cuba and the Isle of Pines by G. F. Moznette and H. L. Sanford.

The survey work in Mexico extended from September 21 to December 31 and had for its object the reexamination of the fruit-fly conditions, particularly along the west coast of Mexico, including Lower California, and southward to include the State of Jalisco. No evidence was found of the occurrence of the Mexican fruit fly (*Anastrepha ludens*) or other fruit flies along the west coast of Mexico in the States of Sonora, Sinaloa, and Nayarit, nor in Lower California. There was evidence of some occurrence of the Mexican fruit fly at Tepic, and this fly was found more or less throughout the State of Jalisco, very generally attacking sour

oranges and navel and other oranges, and abundantly in the coastal and more tropical regions of the adjacent State of Colima. It was found to rarely attack the ordinary oranges of export, namely, the navel and seedling oranges as grown in the more elevated districts of Jalisco, its decided preference in such regions seeming to be the sour orange. As a result of this exploration it seemed reasonable at least to permit the export of oranges from the State of Lower California to Canada by rail in bond through the United States, over prescribed routes, as is now permitted of oranges grown in the State of Sonora. The abundant occurrence, however, of the Mexican fruit fly, which is particularly an enemy of citrus fruits, and also the occurrence of other fruit flies in Jalisco, make it undesirable to modify otherwise the existing embargo as to oranges and certain other fruits from Mexico. The recognized possibility of spread northward of this Mexican orange fly makes it undesirable to permit any consumption entry into the United States of Mexican oranges.

The survey work in Cuba and in the Isle of Pines consisted of a series of investigations at different seasons, beginning in November, 1923, and carrying through the summer of 1924, for the purpose of determining whether or not the avocados and grapefruit grown in these regions were free from fruit fly and other injurious insect attack and therefore safe for commercial entry at southern ports of the United States. With the general knowledge of their apparent freedom from attack, provision had already been made for the entry of such fruits at northern ports where any infestation could be detected under conditions comparatively free from risk of local establishment of new fruit pests. In the course of these surveys these fruits appeared to be free from attack by fruit flies or other insects dangerous to the fruit cultures of the United States and entry at certain southern ports under adequate restrictions and inspection has been provided for.

Incidental to this survey it was learned that Mexican fruit was still being permitted entry in considerable quantities into Cuba, and much of this fruit in the Cuban markets was found to be infested with the Mexican fruit fly, involving very large risk to the future fruit cultures of Cuba. This information was brought to the attention of the authorities and a strict enforcement of the prohibition of further entry of such fruit was promised. This discovery, made in November, 1923, made it necessary to carry out



the surveys referred to above with great thoroughness during the season of 1924 on account of the possibility of the establishment of the Mexican fruit fly, a very serious citrus pest in Mexico and Central America. These surveys, however, gave no evidence that such establishment had so far been effected.

A survey of Colombia and Central America was conducted by Dr. William M. Mann between February and June, 1924, beginning with Colombia.

The principal object in the investigation of Colombia was the desire on the part of Colombian authorities to have entry authorized of the considerable avocado production which had been developed particularly for the American market. The survey made by Doctor Mann in February and the first of March covered the principal avocado district of northern Colombia (Santa Marta). No infestation by fruit flies of the avocados of that general area was found and no other infestation by injurious insects harmful to the United States. On the basis, therefore, of this investigation, the entry of avocados from the Santa Marta district of Colombia into the United States at northern ports was authorized under permit and inspection at the port of entry.

The survey of Central America included the States of Costa Rica, Honduras, and Guatemala and covered the period between March 21 and June 2, 1924. The survey of these States had relation particularly to requests for permits to import citrus fruit from certain districts in these countries. The work in Honduras was considerably curtailed by reason of disturbed conditions there. Fruit fly infestation was determined in all three of these countries, and in both Costa Rica and Guatemala the Mexican fruit fly (*Anastrepha ludens*) was found to be established, as well as other species of *Anastrepha*. It was evident from this survey that the entry of citrus and other fruits prohibited by quarantine 56 from these countries was distinctly unsafe.

While the surveys reported above had in each case a special object, a great deal of information was secured with respect to the fruit fly and other enemies of various fruits which will be of great future service to the board.

#### PLANT-QUARANTINE CONFERENCE

A very important conference of State quarantine officials was held in Washington April 28 to 30, 1924. This conference was convened at the call of the Federal Horticultural Board and had for its purpose to eliminate con-

flict in the exercise of Federal and State plant quarantine powers, and to secure fuller cooperation in the enforcement of plant quarantines on the part of State and Federal authorities. Official delegates, representing some 21 States, chiefly central and eastern, were in attendance, and also officials of the Federal Horticultural Board, the office of the solicitor of the department, and officers of other bureaus cooperating with the board in the enforcement of Federal quarantines.

Immediately upon convening, the delegates elected W. C. O'Kane, State entomologist of New Hampshire, permanent chairman of the conference, and R. C. Althouse, assistant to the chairman of the Federal Horticultural Board, was chosen secretary.

The need for such conference grew out of the great number of State embargoes placed upon the movement of plants and plant products from areas infested with dangerous pests and diseases, many of which were more or less in conflict with Federal quarantines providing for movement of the products in question under inspection and certification.

The conference opened with a general discussion of the legal phases of State and Federal quarantines based on a very complete analysis prepared by the solicitor of the department of the limitations of Federal and State quarantine powers as determined by decisions of the United States Supreme Court. There followed a detailed examination and discussion of the existing State quarantines, which in some cases were in conflict, and in other cases, paralleled Federal plant quarantines.

At the conclusion of these discussions a committee was appointed by the chairman of the conference composed of the members of the Federal Horticultural Board and five State officials, to draft recommendations of agreement for the consideration of the conference. The report of this committee, with the unanimous indorsement of all its members, was submitted to the conference on the morning of April 30, and after full discussion and slight amendment was unanimously adopted.

This agreement was subsequently presented at the sessions of the Western Plant Quarantine Board in Denver, in May, and after full discussion by this board, an association of the plant quarantine officials of 11 of the Western States, was approved and adopted by that body. This agreement was later submitted to all States not represented at either of these conferences and has received the indorsement of such States, so that now it is approved and indorsed

by the 48 States of the Union, as well as by Porto Rico and Hawaii. A full report of this conference is given in the service and regulatory announcements of the Federal Horticultural Board for April-June, 1924, pages 67 to 79, including the summary of the Supreme Court decisions and the text of the recommendations as adopted.

In general, the conclusions reached involve understandings to limit embargoes on the movement of plants and plant products to subjects which can not be safeguarded by lesser restrictions under permit, inspection, and disinfection, with the object of placing as little restriction as is possible with safety on the interstate movement of products. The States further agreed to so limit quarantines as not to conflict with Federal quarantines and to revise or modify any existing quarantines which were in such conflict. Provision was also made for the correlation and cooperation between State and Federal quarantines, and for advance notification on the part of States of proposed action, such advance notification being already provided for in the case of Federal action under the terms of the plant quarantine act.

An admirable spirit of cooperation was manifested throughout the conference, and the understandings and agreements reached have already resulted in eliminating much of the conflict between State and Federal quarantine action, and promise to largely prevent such conflict in the future.

## PLANT-QUARANTINE INSPECTION

### EXTENT OF FIELD

The Plant - Quarantine Inspection Service is responsible for the enforcement at all maritime ports of entry and interior points, including the District of Columbia, of all plant quarantines under the jurisdiction of the Federal Horticultural Board. This work embraces the following features:

(1) The inspection of all vessels arriving at ports of entry from foreign ports and, in many cases, from domestic ports.

(2) The inspection and disposition of all plants and plant products under restriction found in passengers' baggage by United States customs officials.

(3) The inspection of all restricted plants and plant products, including nursery stock, seeds and bulbs, and fruits and vegetables carried as cargo and offered for entry into the United States from all foreign countries and localities, and in certain cases from domestic territory.

(4) Disinfection (fumigation or sterilization) when necessary as a condition of entry of such plants and plant products.

(5) Inspection, in cooperation with customs and post-office officials, of restricted plants and plant products arriving in the mail by foreign parcel post.

(6) Inspection of plant introduction gardens of the Bureau of Plant Industry.

### MARITIME PORT INSPECTION

The board now has inspectors stationed at Astoria, Oreg.; Baltimore, Md.; Boston, Mass.; Charleston, S. C.; Galveston, Tex.; New Orleans, La.; New York City; Philadelphia, Pa.; Portland, Oreg.; and Seattle, Wash. An inspection service has also been recently inaugurated at Chicago, Ill., and St. Louis, Mo.

In collaboration with the States concerned, inspection is conducted at Eureka, Gaviota, San Luis Obispo, San Francisco, San Pedro, and San Diego, Calif.; at Gulfport and Pascagoula, Miss.; Pensacola, Tampa, Key West, Miami, and Jacksonville, Fla.; and at Savannah, Ga. In collaboration with the United States Customs Service, inspection is conducted at Mobile, Ala.; Newport News and Norfolk, Va.; and at Portland, Me. In practically every State the State entomologist, and in some instances his assistant, have been appointed collaborators and assist in the enforcement of the board's quarantines and regulations at interior points.

### INSPECTION OF VESSELS

Vessels from foreign countries and localities are met on arrival and boarded by inspectors or collaborators of the board, and a thorough search made of storerooms, ice boxes, fruit and vegetable lockers, crew's quarters, and passengers' quarters. If material is found which is contraband under the quarantine regulations, adequate safety measures are invoked. Frequently, destruction is the only practical safeguard and this method is often followed. The inspection extends to plants carried by vessels for decorative purposes, and any pest infestation is properly safeguarded. Prohibited or restricted material which may be concealed on the vessel and may not be found by the inspectors is prevented landing through the cooperation of the United States Customs Service, which maintains guards on vessels from foreign ports. Vessels are board-



ed in the stream or at the dock, depending largely on the possibility of the presence of dangerous material, such as fruit-fly infested fruits and vegetables.

*Ships inspected during the fiscal year 1924, exclusive of California and Florida ports.*

	In- spected	With contra- band or re- stricted mate- rial
Astoria, Oreg. (7 months).....	171	92
Baltimore, Md.....	997	333
Boston, Mass.....	1,047	519
Charleston, S. C.....	175	80
Galveston, Tex.....	786	178
Gulfport, Miss.....	8	1
Mobile, Ala. (11 months).....	451	24
New Orleans, La.....	2,302	618
Newport News, Va.....	319	319
New York, N. Y.....	2,506	1,508
Norfolk, Va.....	7	4
Pascagoula, Miss.....	19	3
Philadelphia, Pa.....	1,467	918
Portland, Me. (4 months).....	37	35
Portland, Oreg.....	210	77
Savannah, Ga.....	18	6
Seattle, Wash.....	692	142
Total.....	11,212	4,857

#### BAGGAGE INSPECTION

The inspectors of the Treasury Department examine all baggage carried on vessels from foreign countries and bring to the attention of the board's inspectors, who are always present during this inspection, all plants or plant products, including fruits and vegetables, found in baggage. Inasmuch as traffic with Hawaiian ports is not under the jurisdiction of the customs authorities, baggage from such ports, if inspected, must be inspected by the agents or the collaborators of the board. All baggage from Hawaiian ports is thus inspected by the board for the presence of host fruits of fruit and melon flies, and the finding of infested fruits and vegetables in such baggage is not at all uncommon.

#### CARGO INSPECTION

Commodities under regulation by the board and carried as cargo by vessels from foreign ports cover a wide range of articles and move in great volume. This feature of the work involves the inspection of large shipments of nursery stock, such as fruit and rose stocks, bulbs and tree seeds, immense quantities of fruits and vegetables, large consignments of cotton lint, cotton waste, etc., and such materials as broomcorn

and many other items under regulation. (See tables on pp. 16-28.)

#### DISINFECTION

The board supervises the fumigation under vacuum of foreign cotton and certain related products offered for entry into the United States, and also the sterilization of broomcorn and certain grains and cereals. Vacuum plants are in operation at New York and Boston on the eastern coast, and at San Francisco, Portland, and Seattle on the western coast. A plant at Astoria, Oreg., is nearing completion. Steam sterilization is also available at New York, Boston, and Oakland, Calif. The closest possible supervision is maintained over the operation of these plants, in order that any error, either mechanical or otherwise, may be promptly corrected.

#### INTERIOR INSPECTION

Quantities of nursery stock, plants, bulbs, and fruits and vegetables, as well as restricted cotton products, are brought into the United States by foreign parcel post and offered for entry. The distribution facilities of the Post Office Department have brought the parcel post into popular favor as a transporting agency for plant products, and a wide avenue has been opened to the possible entrance of pests. The necessity of prompt dispatch of mail makes it important that inspection of plant products in the mail be made at every possible strategic point. Through cooperation with the customs and postal officials, arrangements have been made to hold such plant shipments for inspection at points where the board maintains inspectors. In some instances, plant products are forwarded to points where State inspectors, acting as collaborators of the board, are located, thus expediting proper disposition.

#### DISTRICT OF COLUMBIA INSPECTION

This work has continued along the line indicated in the last annual report. Some 15,178 lots of plant material were examined for insects and plant diseases during the fiscal year, and of this number 6,622 were fumigated. Cotton samples numbering 12,927 were received and fumigated before shipment to the consignee and 5,709 containers of domestic plant material arriving by express or in the mails were examined. In addition, 2,529 orders of miscellaneous plants shipped from Bell, Md., introduction gardens of the Bureau of Plant Industry were inspected.



INSPECTION OF PLANT INTRODUCTION  
GARDENS

As has been the practice for a number of years, agents of the board have made inspections of the various plant introduction gardens maintained by the Department of Agriculture at Miami and Brooksville, Fla., Savannah, Ga., Chico, Calif., and Mandan, N. Dak.

## PESTS INTERCEPTED

During the fiscal year the inspectors and collaborators of this service collected on imported plants and plant products 573 recognized species and 251 insects which could only be placed generically.

As elsewhere noted, during the latter part of November, 1923, grapes arriving in this country from Almeria, Spain, were found to be infested with the Mediterranean fruit fly. This fruit fly was also intercepted in peppers and star apples from Hawaii, and in an apple from France. The West Indian fruit fly was found in mangoes from Jamaica and Mexico, and in guavas from Cuba and Jamaica. Other interceptions of fruit flies were as follows: The Mexican fruit fly in oranges from Mexico; the olive fly in olives from Italy; the melon fly in string beans, papaya, and cucumbers from Hawaii; *Anastrepha distans* in mango from Costa Rica; *Anastrepha serpentina* in palm seed from the Canal Zone and in sapodilla from Dominica, British West Indies.

The pink bollworm was taken in cottonseed from China, Egypt, Hawaii, Mexico, and Porto Rico, in cotton bolls from Hawaii and Turkey, and in the seed pods of *Hibiscus cardiophyllus* from Mexico. A cotton stainer, *Dysdercus ruficollis*, was collected on cotton plants from Mexico. *Earias fabia*, an important cotton pest in India, Ceylon, and Australia, was intercepted in boll cotton from India.

Ants, earwigs, and wireworms were intercepted in soil about plants. *Agriotes lineatus* was found in soil about the roots of amaryllis from Germany. *Agriotes sputator* and *Anthous niger* were taken in soil about privet from Norway. The above wireworms, which represent three of the worst field-crop pests of Europe, are not established in the United States.

The citrus blackfly was intercepted on the leaves of grapefruit and orange from Cuba, on rose and spice leaves from the Bahama Islands, and on the

leaves of orange, tangerine, and *Citrus* sp. from Jamaica. The narcissus fly was found in narcissus bulbs from China, France, and Holland. Fruit stocks from France were infested with the following insects: Brown-tail moth, white tree pierid, dagger moth, sorrel cutworm, and lackey moth. The European corn borer arrived in broomcorn from England and Italy. Broomcorn from Italy was also infested with the durra stem borer, an important enemy of durra and corn in Khartum, Sudan. The bean-pod borer was found to infest Lima beans from Cuba. The Hawaiian sugarcane borer arrived in sugarcane from Hawaii. The avocado weevil was taken in avocados from Panama and the mango weevil in mango seeds from Hawaii.

Two injurious potato weevils, *Rhagosipidius tucumanus* and *Epicaerus cognatus*, were intercepted in potatoes from Peru and Mexico, respectively. The former has been referred to in previous reports. The latter is related to the imbricated snout beetle of this country, and judging from the amount of injuries noted in the infested potatoes, it is a pest which should be strongly guarded against. Infested potatoes which have been found in ships' stores have invariably arrived during the spring months.

## INSPECTION FACILITIES IN WASHINGTON

As has been pointed out in previous reports, the inspection facilities in Washington are inadequate for the inspection work which must be conducted. The material entered under special permit for inspection at Washington, D. C., should be given immediate attention and should be promptly dispatched to the consignee. Under the present congested conditions, it is not always possible to make prompt inspections. Provision should be made for an inspection house of suitable dimensions to insure prompt and adequate inspection under suitable safeguards. Much more space than is now available is needed for the conduct of the ordinary routine fumigation and sterilization work, and there is also need for extra space to carry on necessary experiments in fumigation and sterilization. Provision should also be made for a test ground for the growing of plants which have been fumigated or disinfected, in order to determine the resistance of various plants to hydrocyanic acid gas fumigation and other methods of disinfection and sterilization. It is also essential that there be fully equipped

and properly protected greenhouses in which suspicious material may be placed until it has been definitely determined that no danger can result from its introduction.

### RECORD OF IMPORTS OF RESTRICTED PLANTS AND PLANT PRODUCTS

Under various foreign quarantines, the entry of certain plants and plant products is restricted and made subject to inspection, and, if necessary, disinfection, as a condition of entry for the purpose of excluding various plant diseases and insect pests. Among these restricted plants and plant products are nursery stock, plants and seeds for propagation, fruits and vegetables, grains from certain countries, broom-corn and cotton, cotton waste, cotton wrappings, and cottonseed products.

The records of the importations of these articles are indicated in the following discussion and tables.

### IMPORTATIONS OF NURSERY STOCK, PLANTS AND SEEDS<sup>3</sup>

The importations recorded in Tables 1, 2, 3, and 4 are entered under regulation 3 of quarantine 37, under permits which are made continuing and are unlimited as to quantity which may be imported. The restrictions under this regulation are intended merely to afford opportunity to inspect and if necessary safeguard the products as they are so entered. In the case of Table 1, the entries made in the preceding year are also listed for the purpose of comparison and in Table 3 the bulb entries of the last five years are brought together to show the fluctuation in the entry of different classes of bulbs.

<sup>3</sup> Except as restricted by specific quarantines, field, vegetable, and flower seeds, and plant products imported solely for medicinal, food, or manufacturing purposes, are not restricted as to entry, and the taking out of permits for such articles is not required. No record is therefore kept by the Federal Horticultural Board of the entry of such articles.

TABLE 1.—*Importation of fruit, rose, and nut stocks*

[Figures indicate number of plants]

Kind of stock	England	France	Germany	Holland	Ireland	Italy	Scotland	Spain	Total	
									1923-24	1922-23
Fruit:										
Apple.....	24	4, 131, 595	34, 000	90, 250		350, 000			4, 605, 869	3, 920, 910
Cherry.....		11, 118, 250	6, 300	127, 100		96, 500			11, 348, 150	10, 182, 525
Grape.....		1, 788				150		50	1, 988	10, 840
Olive.....								50	50	
Pear.....		3, 632, 140	10, 800	51, 600		51, 000			3, 745, 540	3, 037, 294
Pineapple.....										100
Plum.....		3, 223, 950	10, 400	41, 000		76, 000			3, 351, 350	2, 948, 665
Quince.....		1, 018, 500	2, 000	12, 000		11, 000			1, 043, 500	975, 250
Rose.....	3, 083, 016	2, 444, 000		4, 403, 117	156, 300		40, 000		10, 126, 433	7, 575, 409
Nut.....		24, 950							24, 950	35, 800
Total.....	3, 083, 040	25, 595, 173	63, 500	4, 725, 067	156, 300	584, 650	40, 000	100	34, 247, 830	28, 686, 793

TABLE 2.—*Importation of bulbs, 1923-24*

[Figures indicate number of bulbs]

Bulb	Bermuda	Canada	China	England	France	Germany
Crocus.....		200		629		
Eranthis.....				588	500	
Fritillaria.....				454	100	
Galanthus.....		100		1, 654	900	
Hyacinths.....		12		165	890, 830	
Ixia.....				684	1, 000	
Lily.....	569, 225		150	1, 535	271, 382	
Lily of the Valley.....						17, 059, 470
Muscari.....				2, 062	500	
Narcissus.....			1, 422, 666	725, 520	49, 285, 605	
Seilla.....		100		8, 727	700	
Tulips.....		1, 000		1, 963	148, 935	
Total.....	569, 225	1, 412	1, 422, 816	743, 981	50, 600, 452	17, 059, 470

TABLE 2.—*Importation of bulbs, 1923-24—Continued*

[Figures indicate number of bulbs]

Bulb	Holland	Ireland	Italy	Japan	Wales	Total
Chionodoxa.....	339,766					339,766
Crocus.....	10,815,007	84				10,815,920
Eranthis.....	92,226					93,314
Fritillaria.....	92,397					92,951
Galanthus.....	794,727					797,381
Hyacinths.....	31,303,963		2,770			32,197,740
Ixia.....	333,474					335,158
Lily.....	175,725		27,299	8,645,170		9,690,486
Lily of the Valley.....	499,225			10,140		17,568,835
Muscari.....	609,767					612,329
Narcissus.....	41,112,273	60	8,200	105,240	102	92,659,666
Scilla.....	985,235					994,762
Tulips.....	92,386,899				360	92,539,157
Total.....	179,540,684	144	38,269	8,760,550	462	258,737,465

TABLE 3.—*Importation of bulbs during the years stated*

Bulb	1923-24	1922-23	1921-22	1920-21	1919-20
Chionodoxa.....	339,766				
Crocus.....	10,815,920	8,286,500	6,319,082	5,514,805	3,977,892
Eranthis.....	93,314				
Fritillaria.....	92,951				
Galanthus.....	797,381				
Hyacinths.....	32,197,740	29,142,797	24,808,236	22,568,891	16,375,494
Ixia.....	335,158				
Lily.....	9,690,486	9,145,630	8,219,460	22,490,533	14,538,936
Lily of the valley.....	17,568,835	19,603,092	14,951,170	3,606,746	9,964,847
Muscari.....	612,329				
Narcissus.....	92,659,666	77,193,281	77,270,548	77,956,195	56,032,918
Scilla.....	994,762				
Tulips.....	92,539,157	76,719,116	64,846,940	55,075,343	49,972,184
Unclassified.....		183,900	70,750	4,756,369	1,653,790
Total.....	258,737,465	220,274,316	196,486,186	191,968,882	152,516,061

TABLE 4.—*Importation of tree seeds, 1923-24 and 1922-23*

[Figures indicate number of pounds]

Country of origin	Apple	Cherry	Nuts and palm	Orna-mental and tree	Pear	Per-simmon	Plum	Quince	Rose	Total
Africa.....				40						40
Australia.....			26,028	267						26,295
Austria.....	10	511		5,884	45		210		15	6,675
Brazil.....			1,197							1,197
Canada.....				1,060						1,060
Chile.....		323								323
China.....				1,350	6		3,161			4,517
Czechoslovakia.....		1,135		110						1,245
Denmark.....				682						682
France.....	25,463	5,460	108	6,472	928	20	856	5	10	39,322
Germany.....				1,554						1,554
Guiana (British).....			20							20
Italy.....			225	672						897
Japan.....		110	91	8,544	1,412	802	6,429	66	1,281	18,735
New Zealand.....				8						8
Poland.....							1			1
Siam.....			375							375
Spain.....				50						50
Straits Settlements.....				1						1
Sweden.....				359						359
West Indies.....			914							914
Total.....	25,473	7,539	28,958	27,053	2,391	822	10,657	71	1,306	104,270
1922-23.....	21,225	2,661	35,515	15,724	7,819	1,601	8,263	246	814	93,868



The distribution within the United States of the classes of nursery stock recorded in the above Tables 1, 2, 3, and 4, is indicated in Table 5.

TABLE 5.—*Distribution, by States, of bulbs, nursery stock, and seeds imported under regular permit during fiscal year ended June 30, 1924*

[Figures indicate number of cases]

State	Bulbs	Fruit stocks	Rose stocks	Nut stocks
Alabama	350	3		
Alaska	8			
Arizona	56	1		
Arkansas	299	2		
California	5,302	18	4	
Colorado	870	1	8	
Connecticut	3,339	154	159	
Delaware	377	2		
District of Columbia	856			
Florida	144			
Georgia	1,106	1		
Idaho	77			
Illinois	31,049	10	111	
Indiana	2,110	67	49	
Iowa	2,390	261	37	
Kansas	776	56		
Kentucky	982		1	
Louisiana	259			
Maine	594			
Maryland	1,291	17	3	
Massachusetts	8,287	2	11	
Michigan	6,288	145	22	
Minnesota	2,191		3	
Mississippi	279		2	
Missouri	2,099	17	8	
Montana	270			
Nebraska	638	12		
Nevada	2			
New Hampshire	351		1	
New Jersey	10,296	20	139	
New Mexico	41			
New York	55,838	714	318	5
North Carolina	766	18		
North Dakota	124		1	
Ohio	9,940	106	114	1
Oklahoma	471	3	1	
Oregon	1,300	4	2	
Pennsylvania	21,873	50	41	1
Rhode Island	1,541			
South Carolina	822		3	
South Dakota	108		3	
Tennessee	1,460	7	5	
Texas	1,727		1	
Utah	408	1	1	
Vermont	392	1		
Virginia	1,489	9	1	
Washington	2,775	5		
West Virginia	636			
Wisconsin	2,742		8	
Wyoming	47			
Exported by per- mittees	835	20	7	
Total	188,271	1,727	1,061	7
1922-23	162,313	1,582	879	10

TABLE 5.—*Distribution, by States, of bulbs, nursery stock, and seeds imported under regular permit during fiscal year ended June 30, 1924—Con.*

State	Seeds (pounds)				Total
	Fruit	Nut and palm	Orna-mental and tree	Rose	
Alabama		21	9		30
California	3,771	10,225	567		14,563
Colorado		10	21		31
Connecticut	130	992	106	25	1,253
District of Columbia		41	51		92
Florida	150	2,014	231		2,395
Georgia	2,736		375		3,111
Illinois	3,544	1,986	10,334	190	16,054
Indiana			2		2
Iowa	500		1,227		1,727
Kansas	21,527	12	70		21,609
Kentucky		1			1
Louisiana			7		7
Maryland	1				1
Massachusetts		187	121		308
Michigan	1		52		53
Minnesota		31	3		34
Missouri	2,192	90			2,282
Nebraska			102		102
New Hampshire			391		391
New Jersey	76	1,614	347	475	2,512
New York	349	2,030	1,903	240	4,522
North Carolina	2		87		89
Ohio		385	182		567
Oregon	126	86	13		225
Pennsylvania	5,758	8,411	10,023	376	24,568
South Carolina		11	5		16
Tennessee		77			77
Texas	4,018	188	3		4,209
Vermont			125		125
Virginia		26			26
Washington	2,042	230	263		2,535
Wisconsin	30	100	283		413
Exported by per- mittees		190	150		340
Total	46,953	28,958	27,053	1,306	104,270
1922-23	41,815	35,515	15,724	814	93,868

The record of entry under special permits issued under the provisions of regulation 14 of quarantine 37 for the purpose of keeping the country supplied with new varieties and necessary propagating stock, and to meet other technical and educational needs is given in Table 6.

During the fiscal year 1924, 1,107 such permits were issued authorizing the entry of 15,381,621 plants and bulbs. During the year importations were made under 862 of these permits, of

a total of 12,561,306 plants and bulbs. A summary of permits issued during the period of the quarantine is given in Table 7. It is interesting to note that the number of plant varieties considered during the five years of the quarantine has now reached a total of 19,016, of which 17,400 have been approved for entry.

In addition to the table mentioned, there has been prepared an additional table (Table 8) showing the distribution of the imported special permit material by States. (See also p. 20.)

TABLE 6.—*Special permit importations, fiscal year 1924, with combined totals for 1920, 1921, 1922, 1923, and 1924*

Class of plants	Fiscal year 1924			
	Permits issued		Permits imported	
	Num-ber	Quantity	Num-ber	Quantity
Gladioli.....	140	8, 509, 189	128	8, 066, 850
Dahlia.....	70	6, 527	62	4, 883
Iris:				
rhizomatous.....	144	38, 529	116	23, 502
bulbous.....	164	4, 285, 987	122	3, 005, 194
Peonies.....	173	267, 967	119	85, 652
Other bulbs, rhizomes, and roots.....	135	1, 130, 991	90	807, 431
Ornamentals.....	81	409, 057	62	193, 706
Roses.....	150	18, 578	143	14, 061
Orchids.....	191	21, 686	132	18, 987
Herbaceous plants.....	146	692, 071	113	340, 661
Small fruits and fruit trees.....	9	1, 039	6	379
Total.....		15, 381, 621		12, 561, 306

TABLE 6.—*Special permit importations, fiscal year 1924, with combined totals for 1920, 1921, 1922, 1923, and 1924—Continued*

Class of plants	Grand totals, 1920-1924			
	Permits issued		Permits imported	
	Num-ber	Quantity	Num-ber	Quantity
Ornamentals.....	422	1, 995, 241	285	1, 216, 172
Roses.....	380	89, 618	316	65, 707
Orchids.....	416	76, 681	322	51, 322
Herbaceous plants.....	437	2, 865, 831	293	1, 322, 014
Small fruits and fruit trees.....	37	5, 933	15	698
Total.....		64, 847, 680		37, 879, 567

#### SUMMARY FOR THE YEARS 1920-1924

Fiscal year	Permits issued		Permits imported	
	Num-ber	Quantity	Num-ber	Quantity
1920.....	311	10, 752, 844	171	3, 484, 195
1921.....	622	13, 965, 013	411	8, 132, 634
1922.....	750	9, 573, 199	518	3, 344, 026
1923.....	897	15, 175, 003	719	10, 357, 406
1924.....	1, 107	15, 381, 621	862	12, 561, 306
Grand total.....	3, 687	64, 847, 680	2, 681	37, 879, 567

TABLE 7.—*Special permit material: Number of different varieties of plants requested and approved for the fiscal years 1920-1924*

Class of plants	Re-quested	Ap-proved	Per-cent-age ap-proved
Gladiolus.....	948	831	87. 7
Dahlia.....	1, 809	1, 634	93. 1
Iris:			
rhizomatous.....	1, 584	1, 500	94. 7
bulbous.....	310	308	99. 3
Peonies.....	1, 415	1, 226	86. 6
Other bulbs, rhizomes, and roots.....	1, 667	1, 631	97. 8
Ornamentals.....	2, 696	2, 169	80. 5
Roses.....	2, 155	1, 802	83. 6
Orchids.....	3, 703	3, 654	98. 7
Herbaceous plants.....	2, 585	2, 464	95. 3
Small fruits and fruit trees.....	144	131	90. 9
Total.....	19, 016	17, 400	91. 5

Class of plants	Grand totals, 1920-1924			
	Permits issued		Permits imported	
	Num-ber	Quantity	Num-ber	Quantity
Gladioli.....	646	34, 838, 372	482	22, 141, 885
Dahlia.....	269	22, 278	210	15, 203
Iris:				
rhizomatous.....	503	136, 799	388	55, 997
bulbous.....	417	17, 339, 919	257	9, 931, 415
Peonies.....	492	1, 000, 226	342	274, 286
Other bulbs, rhizomes and roots.....	427	6, 476, 782	263	2, 804, 868

TABLE 8.—*Distribution of special permit material by States for fiscal years 1920-1924*

State	Gladiolus	Dahlia	Rhizomatous iris	Bulbous iris	Peony	Rose	Orchid	Ornamental and miscellaneous plants	Grand total of all imported material
Alabama.....	14, 985	0	0	15, 980	0	174	0	0	31, 139
Arizona.....	0	0	0	0	0	0	0	17	17
Arkansas.....	0	0	0	0	0	0	0	0	0
California.....	1, 677, 365	2, 786	12, 941	6, 676, 281	2, 156	7, 373	17, 342	961, 122	9, 357, 366
Colorado.....	14, 652	0	0	20, 990	0	0	340	3, 473	39, 455
Connecticut.....	500	496	625	0	54	30, 713	0	49, 899	82, 287
Delaware.....	0	0	0	0	0	0	6	1, 019	1, 025
District of Columbia.....	0	70	0	0	0	61	47	226	404
Florida.....	22, 515	0	0	278, 920	0	21	0	207, 768	509, 224
Georgia.....	0	0	0	59, 910	0	0	0	510	60, 420
Idaho.....	0	0	0	2, 000	0	0	0	0	2, 000
Illinois.....	2, 780, 917	33	8, 621	510, 015	14, 967	1, 027	448	171, 078	3, 487, 106
Indiana.....	2, 060, 333	186	1, 058	2, 265	496	1, 269	0	453	2, 066, 060
Iowa.....	38, 235	0	0	0	15, 052	0	0	12, 174	65, 461
Kansas.....	0	0	74	0	0	0	0	43	117
Kentucky.....	0	242	0	50, 000	0	0	152	0	50, 394
Louisiana.....	2, 000	110	0	19, 500	0	0	0	250	21, 860
Maine.....	350	0	0	0	209	0	0	60	619
Maryland.....	20, 057	242	35	101, 000	18, 085	0	0	1, 118	140, 537
Massachusetts.....	1, 694, 680	681	2, 825	151, 840	3, 610	1, 306	7, 358	216, 417	2, 078, 717
Michigan.....	11, 220, 960	1, 448	1, 994	265, 340	22, 673	265	47	269, 433	11, 782, 160
Minnesota.....	78, 081	44	792	0	1, 289	160	72	67	80, 505
Mississippi.....	6, 500	0	9	49, 776	0	0	0	27	56, 312
Missouri.....	2, 450	0	150	12, 225	241	0	2, 933	18, 881	36, 880
Montana.....	0	0	0	0	0	0	0	100	100
Nebraska.....	0	276	0	0	14	0	0	30	320
Nevada.....	0	0	0	0	0	0	0	0	0
New Hampshire.....	40, 021	0	0	1, 500	0	0	0	0	41, 521
New Jersey.....	91, 885	2, 896	7, 348	277, 753	16, 083	17, 171	10, 945	1, 563, 062	1, 987, 143
New Mexico.....	0	0	0	0	0	0	0	0	0
New York.....	1, 566, 680	2, 023	3, 781	505, 005	87, 268	2, 359	7, 046	1, 306, 730	3, 480, 892
North Carolina.....	3, 975	0	0	7, 990	0	0	0	24	11, 989
North Dakota.....	0	0	0	0	7	0	0	0	7
Ohio.....	443, 811	677	9, 099	2, 904	59, 757	967	81	286, 664	803, 960
Oklahoma.....	510	0	0	8, 000	0	0	0	198	8, 708
Oregon.....	35, 321	677	523	82, 506	625	669	0	17, 407	137, 728
Pennsylvania.....	252, 554	1, 283	2, 212	68, 472	24, 465	359	3, 444	194, 482	547, 271
Rhode Island.....	616	911	551	190	2, 209	155	47	12, 371	17, 050
South Carolina.....	0	0	0	10, 000	0	0	0	0	10, 000
South Dakota.....	0	0	11	0	2, 410	587	0	84	3, 092
Tennessee.....	0	54	361	114, 266	222	0	0	1, 400	116, 303
Texas.....	2, 000	0	0	137, 980	0	65	0	125	140, 170
Utah.....	0	0	0	0	0	0	0	497	497
Vermont.....	2, 016	0	0	0	1, 000	0	0	145	3, 161
Virginia.....	16, 000	0	2	348, 004	898	0	0	7, 766	372, 670
Washington.....	13, 178	68	2, 574	88, 853	28	511	0	14, 587	119, 799
West Virginia.....	0	0	0	4, 000	0	0	0	36	4, 036
Wisconsin.....	38, 738	0	411	57, 950	468	495	1, 014	24, 009	123, 085
Wyoming.....	0	0	0	0	0	0	0	0	0
Total.....	22, 141, 885	15, 203	55, 997	9, 931, 415	274, 286	65, 707	51, 322	5, 343, 752	37, 879, 567

## IMPORTATIONS OF COTTON AND COTTON PRODUCTS

Tables 9 to 12 indicate, respectively, the importations of cotton, cotton waste, bagging, cottonseed, seed cotton,

and cottonseed products during the year.

The actual number of bales of cotton, cotton waste, and bagging is indicated, but inasmuch as bales vary in size they are referred to as "running bales."



TABLE 9.—Imports ginned cotton by country of growth and port of entry 1923-24, in running bales

Ports	Balti- more	Boston	Calexico	Houston	Newport, Vt.	New York	Niagara Falls	Nyando
Arabia.....						12		
Australia.....						2		
Brazil.....						34		
British West Indies.....						33		
China.....		4, 408				10, 735		
Dominican Republic.....						200		
Dutch East Indies.....		24				1, 100		
Egypt.....		88, 441				26, 132		
Haiti.....						5, 034		
India.....		10, 167				32, 931		
Mexico.....			88, 409			1, 042		
Nicaragua.....						25		
Peru.....		69				102, 914		
Porto Rico.....						1, 131		
United States.....	1	1, 142		139	506	224	356	80
Total.....	1	104, 251	88, 409	139	506	181, 549	356	80

Ports	Port Huron	Port- land, Oreg.	Rich- ford	Rouses Point	St. Albans	San Fran- cisco	Seattle	Vance- boro	Total
Arabia.....									12
Australia.....									2
Brazil.....									34
British West Indies.....									33
China.....		1, 133				25, 919	4, 771		46, 966
Dominican Repub- lic.....									200
Dutch East Indies.....									1, 124
Egypt.....									114, 573
Haiti.....									5, 034
India.....						550			43, 648
Mexico.....						94			89, 545
Nicaragua.....									25
Peru.....									102, 983
Porto Rico.....									1, 131
United States.....	6		46	1	257			800	3, 558
Total.....	6	1, 133	46	1	257	26, 563	4, 771	800	1 408, 868

<sup>1</sup> Includes 1,165 bales of linters.

TABLE 10.—Imports of cotton waste by country of origin and port of entry, 1923-1924, in running bales

Country	Balti- more	Boston	Buffalo	Charles- ton	New Orleans	Newport, Vt.	New York	Phila- delphia
Belgium.....		260			342		52	1, 126
Brazil.....		107					820	
Canada.....		3, 474	36			31	106	
Ceylon.....							40	
China.....		712					560	
Cuba.....							66	
England.....	942	7, 730		1, 438	910		2, 910	2, 554
France.....		196					449	23
Germany.....		159					808	59
Holland.....		7, 843					2, 757	1, 243
India.....		100					3, 467	167
Italy.....		1, 354					2, 449	1, 414
Japan.....		177					275	325
Mexico.....							251	
Scotland.....							115	
Spain.....							1, 745	717
Switzerland.....		1, 033					1, 017	244
United States.....								10
Total.....	942	23, 145	36	1, 438	1, 252	31	17, 887	7, 882

TABLE 10.—Imports of cotton waste by country of origin and port of entry, 1923–1924, in running bales—Continued

Country	Port-land, Ore.	Rich-ford	Rouses Point	St. Albans	San Francisco	Savan-nah	Seattle	Utica	Total
Belgium.....									1,780
Brazil.....									927
Canada.....		42	132	152				37	4,010
Ceylon.....									40
China.....	90				82		627		2,071
Cuba.....									66
England.....						204			16,688
France.....					100				668
Germany.....									1,126
Holland.....									11,843
India.....									3,734
Italy.....									5,217
Japan.....					3,483		7,214		11,474
Mexico.....									251
Scotland.....									115
Spain.....									2,462
Switzerland.....					90				2,384
United States.....			8						18
<b>Total.....</b>	<b>90</b>	<b>42</b>	<b>140</b>	<b>152</b>	<b>3,755</b>	<b>204</b>	<b>7,841</b>	<b>37</b>	<b>64,874</b>

TABLE 11.—Imports of bagging by country of origin and port of entry, 1923–1924, in running bales

Country	Balti-more	Boston	Charles-ton	Detroit	New Orleans	New York
Algeria.....						66
Belgium.....	1,748	91	371		1,083	3,379
Canada.....		3		916		1,361
Denmark.....						1,172
Egypt.....		217				39
England.....	2,003	1,864			6,938	7,077
France.....	279	254			1,557	6,448
Germany.....	382	390	677			3,608
Holland.....	886	563	859		1,199	8,806
Ireland.....						344
Italy.....						325
Japan.....						1
Mexico.....						90
Scotland.....	58	11	49			1,931
Spain.....					935	2,741
Switzerland.....						729
<b>Total.....</b>	<b>5,356</b>	<b>3,393</b>	<b>1,956</b>	<b>916</b>	<b>11,712</b>	<b>38,117</b>

Country	Norfolk	Philadel-phia	Port Huron	Portland, Ore.	San Fran-cisco	Savan-nah	Total
Algeria.....							66
Belgium.....	143	3,412			947	153	11,327
Canada.....			436				2,716
Denmark.....		117					1,289
Egypt.....							256
England.....	5,074	6,731				560	30,247
France.....	134	3,296					11,968
Germany.....		875					5,932
Holland.....	368	3,545					16,226
India.....		25					25
Ireland.....							344
Italy.....		180					505
Japan.....				200			201
Mexico.....							90
Scotland.....		882					2,931
Spain.....		250					3,926
Switzerland.....							729
<b>Total.....</b>	<b>5,719</b>	<b>19,313</b>	<b>436</b>	<b>200</b>	<b>947</b>	<b>713</b>	<b>88,778</b>

TABLE 12.—Imports of cottonseed and cottonseed products, 1923-1924, in tons

Port	Cottonseed	Cottonseed cake	Cottonseed meal
Boston.....		64	621
Calexico.....	45,367		
Eagle Pass.....		847	
Total.....	45,367	911	621

## IMPORTATIONS OF FRUITS AND VEGETABLES UNDER QUARANTINE NO. 49

A record of importations of fruits and vegetables from Cuba, the Bahamas, Jamaica, Canal Zone, Costa Rica, India, Philippine Islands, Ceylon, and Java, as restricted by quarantine 49, is indicated in Tables 13 and 14. This record covers the 4-months' period between July 1 and October 31, inclusive. Beginning with November 1, quarantine 49 was replaced by quarantine 56, the record of importations under which are given in Tables 15 and 16.

TABLE 13.—Fruits and vegetables imported under Quarantine No. 49, from July 1, 1923, to November 1, 1923, by ports of entry

Kind	Baltimore	Boston	Key West	Los Angeles
Avocadoes, crates.....			7,894	
Bananas, bunches.....	843,000	639,519	5,262	1,622
Cassava, crates.....			84	
Coconuts, number.....	439,000	120,000		
Dasheens, crates.....			34	
Grapefruit, crates.....		100	64,733	
Mammeas, crates.....			65	
Okra, crates.....			62	
Oranges, crates.....		94	1	
Pepper, crates.....			43	
Pineapples, crates.....		5,255	285	
Plantains, bunches.....		5	9,921	
Pumpkins, crates.....			60	
Soursops, crates.....			63	
Tangerines, crates.....		17		
Exported by permittees: Grapefruit, crates.....			300	

TABLE 13.—Fruits and vegetables imported under Quarantine No. 49, from July 1, 1923, to November 1, 1923, by ports of entry—Continued

Kind	Miami	New Orleans	New York
Avocadoes, crates.....	65	22,149	10,089
Bananas, bunches.....	11,157	61,100	4,136,580
Beans (Lima), crates.....			8
Cassava, crates.....			432
Coconuts, number.....	1,700		10,274,667
Copra, bags.....			4,292
Dasheens, crates.....			4
Grapefruit, crates.....		4,127	68,062
Lemons, crates.....		5	
Limes, crates.....		24	472
Mammeas, crates.....		49	21
Mangoes, crates.....		620	497
Oranges, crates.....		10	215
Papaya, crates.....			7
Pineapples, crates.....		4,907	64,369
Plantains, bunches.....			1,087
Sapodillas, crates.....	28		
Exported by permittees:			
Grapefruit, crates.....			24,248
Oranges, crates.....			1,065
Pineapples, crates.....			3

Kind	Philadelphia	Tampa	Total
Avocadoes, crates.....		15,831	56,028
Bananas, bunches.....	1,380,579	20	7,078,839
Beans (Lima), crates.....			8
Cassava, crates.....		158	674
Coconuts, number.....	776,600		11,611,967
Copra, bags.....			4,292
Dasheens, crates.....		42	80
Garbanzos, crates.....		8	8
Grapefruit, crates.....			137,022
Lemons, crates.....			5
Limes, crates.....	11		507
Mammeas, crates.....		75	210
Mangoes, crates.....			1,117
Okra, crates.....			62
Oranges, crates.....			320
Papaya, crates.....		8	15
Pepper, crates.....			43
Pineapples, crates.....		531	75,347
Plantains, bunches.....		85,500	96,513
Pumpkins, crates.....		50	110
Sapodillas, crates.....			28
Soursops, crates.....		45	108
Tangerines, crates.....			17
Exported by permittees:			
Grapefruit, crates.....			24,548
Oranges, crates.....			1,065
Pineapples, crates.....			3



TABLE 14.—*Fruits and vegetables imported under quarantine No. 49, from July 1, 1923, to November 1, 1923, by countries of origin*

Kind	Bahamas	Canal Zone	Costa Rica	Cuba	Jamaica	Total
Avocados, crates	65			55,963		56,028
Bananas, bunches		358,467	1,317,750	864,151	4,538,471	7,078,839
Beans (Lima), crates				8		8
Cassava, crates				674		674
Coconuts, number	1,700	5,801,917		290,100	5,518,250	11,611,967
Copra, bags		210			4,082	4,292
Dasheens, crates				80		80
Garbanzos, crates				8		8
Grapefruit, crates			213	136,712	97	137,022
Lemons, crates				5		5
Limes, crates			467	29	11	507
Mammeas, crates				210		210
Mangoes, crates				1,117		1,117
Okra, crates				62		62
Oranges, crates			316	1	3	320
Papaya, crates				15		15
Pepper, crates				43		43
Pineapples, crates			15,012	60,333	2	75,347
Plantains, bunches		411	5	96,097		96,513
Pumpkins, crates				110		110
Sapodillas, crates	28					28
Soursops, crates				108		108
Sugar apples, crates				11		11
Tangerines, crates			17			17
Exported by permittees:						
Grapefruit, crates	22			16,931	7,595	24,548
Oranges, crates					1,065	1,065
Pineapples, crates					3	3

TABLE 15.—*Fruits and vegetables imported under quarantine 56, November 1, 1923, to June 30, 1924, by countries of origin*

[Figures indicate crates, cases, boxes, packages, casks, bags, and bundles, unless otherwise designated]

Kind	Country and amount	Total
Apricots	Argentina, 1	1.
Artichokes	Chile, 49	49.
Asparagus	Argentina, 700; Chile, 95; Mexico, 5 pounds	795 and 5 pounds.
Avocados	Colombia (Santa Marta), 602; Cuba, 5,403; Dominican Republic, 3.	6,008.
Ayales	Mexico, 2	2.
Bananas, bunches	Canal Zone, 357,671; Colombia, 2,160,500; Costa Rica, 2,392,006; Cuba, 1,350,192; Dominican Republic, 41; Guatemala, 3,355,607; Honduras, 7, 844,756; British Honduras, 349,200; Jamaica, 5,530,833; Martinique, French West Indies, 146; Mexico, 2,058,940; Nicaragua, 2,124,966; Panama, 1,894,998.	29,419,856.
Beans:		
Fava	Bermuda, 3,576	3,576.
Lima	Bermuda, 175; Cuba, 48,079; Mexico, 2 and 69 pounds	48,256 and 69 pounds.
String	Cuba, 156; Mexico, 889 and 6,794 pounds	1,045 and 6,794 pounds.
Beets	Bahamas, 123; Bermuda, 28,118; Mexico, 61,661 pounds	28,241, and 61,661 pounds.
Burdock	Japan, 14	14.
Cabbage	Bahamas, 10; Bermuda, 13; Cuba, 263; Holland, 50,241; Mexico, 664 and 3,542 pounds.	51,191 and 3,542 pounds.
Carrots	Argentina, 21; Bahamas, 379; Bermuda, 166,880; Denmark, 1,500; Holland, 21,816; Mexico, 2 and 118,315 pounds.	190,598 and 118,315 pounds.
Cassava	Cuba, 1,347	1,347.
Cauliflower	Argentina, 122; France, 75; Mexico, 85	282.
Celery	Argentina, 11; Belgium, 10; Bermuda, 32,882; Mexico, 4 and 455 pounds.	32,907 and 455 pounds.
Chayotes	Cuba, 500; Dominican Republic, 5; Jamaica, 1; Mexico, 1,703 pounds.	506 and 1,703 pounds.
Cherries	Argentina, 168; Chile, 1,479	1,647.
Cipolline	Greece, 2; Italy, 28,220	28,222.
Crosnes	Belgium, 432	432.
Cucumbers	Bermuda, 143; Cuba, 3,507; Mexico, 15,785 and 1,255 pounds	19,435 and 1,255 pounds.
Dasheens	Azores, 757 and 1,650 pounds; China, 5,670; Cuba, 1,042; Dominican Republic, 242; Japan, 3,163; Madeira, 16; Mexico, 88.	10,978 and 1,650 pounds.
Eggplants	Argentina, 4; Cuba, 81,888; Honduras, 120; Mexico, 8,933 and 223 pounds	90,945 and 223 pounds.

TABLE 15.—*Fruits and vegetables imported under quarantine 56, November 1, 1923, to June 30, 1924, by countries of origin—Continued*

Kind	Country and amount	Total
Endives.....	Belgium, 56,810; England, 60; Germany, 277.....	57,147.
Fennel.....	Bermuda, 296.....	296.
Garbanzos, pounds.....	Mexico, 10.....	10.
Garlic.....	Argentina, 2; Chile, 313; Egypt, 246; Hungary, 150; Italy, 6,024; Mexico, 3,471 and 27,658 pounds; Spain, 58.....	10,264 and 27,658 pounds.
Ginger (crude).....	China, 2,859; Cuba, 2; Jamaica, 25; Japan, 11.....	2,897.
Grapes <sup>1</sup> .....	Argentina, 2,516; Australia, 44; Belgium, 19,673; Chile, 6,358; England, 234; Germany, 20; Italy, 6,982; Peru, 20; Spain, 591,402.....	627,249.
Grapefruit.....	Bahamas, 24; Cuba, 29,095; Dominica, British West Indies, 2; Jamaica, 244.....	29,365.
Horseradish.....	Germany, 24,709; Poland, 2; Sweden, 1.....	24,712.
Kale.....	Bermuda, 8,671.....	8,671.
Kohl-rabi.....	Bermuda, 17.....	17.
Kudzu.....	China, 984; Japan, 5.....	989.
Lemons.....	Azores, 1; Italy, 418,252; Mexico, 897 and 114 pounds; Spain, 771.....	419,921 and 114 pounds.
Lettuce.....	Bermuda, 4,388; Mexico, 183 and 25,356 pounds.....	4,571 and 25,356 pounds.
Lily bulbs (edible).....	China, 311; Japan, 7.....	318.
Limes (sour).....	Antigua, British West Indies, 54; Costa Rica, 1; Cuba, 4; Dominica, British West Indies, 12,438; Jamaica, 1,334; Mexico, 4,459 and 276,753 pounds; St. Kitts, 175; St. Lucia, 4,703.....	23,168 and 276,753 pounds.
Melons.....	Argentina, 4,685; Chile, 7,908; Cuba, 6; Italy, 478; Mexico, 138,868 and 2,790 pounds.....	151,945 and 2,790 pounds.
Mint.....	Bermuda, 236; Mexico, 1,741 pounds.....	236 and 1,741 pounds.
Mustard.....	Bermuda, 6; Mexico, 1,263 pounds.....	6 and 1,263 pounds.
Nectarines.....	Argentina, 68; Belgium, 13.....	81.
Okra.....	Bahamas, 14; Cuba, 11,210; Jamaica, 3.....	11,227.
Onions.....	Australia, 1,931; Bermuda, 11,180; Brazil, 25; Chile, 23,187; China, 5; Cuba, 8,766; Egypt, 91,603; England, 200; France, 61; Holland, 55; Italy, 2,583; Mexico, 31,412 and 210,088 pounds; Montserrat, 520; Spain, 538,584.....	710,112 and 210,088 pounds.
Oranges.....	Cuba, 1,698; Jamaica, 206; Spain, 1,775.....	3,679.
Pachyrhizus.....	China, 257.....	257.
Parsley.....	Argentina, 100; Bahamas, 118; Bermuda, 56,082; Cuba, 159; Mexico, 5 and 9,258 pounds.....	56,464 and 9,258 pounds.
Parsnips.....	Holland, 1,997.....	1,997.
Peaches.....	Argentina, 10,648; Belgium (hothouse), 13; Chile, 100.....	10,761.
Pears.....	Argentina, 499; Chile, 20.....	519.
Peas.....	Bermuda, 41; Mexico, 35,228 and 1,717 pounds.....	35,269 and 1,717 pounds.
Pepper.....	Argentina, 7; Bahamas, 15; Canal Zone, 120; Cuba, 156,788; Dominican Republic, 4; Haiti, 240; Jamaica, 2; Mexico, 73,548 and 280,754 pounds; Panama, 78.....	230,802 and 280,754 pounds.
Pineapples.....	Azores, 2; Brazil, 937; Canal Zone, 30; Costa Rica, 41,405; Cuba, 1,244,524; Dominican Republic, 1; Honduras, 480; Jamaica, 2; Mexico, 61 and 565 pounds.....	1,287,442 and 565 pounds.
Plantains, bunches.....	Canal Zone, 18,056; Costa Rica, 6; Cuba, 45,559; Dominican Republic, 6,252; Guatemala, 1,240; Haiti, 8; Honduras, 35,713; British Honduras, 88,420; Mexico, 4,101; Panama, 1,731; Venezuela, 21.....	201,107.
Plums.....	Argentina, 2,640.....	2,640.
Potatoes, barrels.....	Bermuda, 32,804.....	32,804.
Pumpkins.....	Cuba, 101; Mexico, 735 and 157 pounds.....	836 and 157 pounds.
Quinces.....	Argentina, 50.....	50.
Radishes, pounds.....	Mexico, 9,251.....	9,251.
Romaine.....	Bermuda, 6.....	6.
Shallots.....	Belgium, 19.....	19.
Sorrel.....	Bermuda, 37.....	37.
Spinach.....	Bermuda, 44; Mexico, 1 and 33,081 pounds.....	45 and 33,081 pounds.
Squash.....	Bermuda, 4; Cuba, 3,056; Mexico, 406 and 8,274 pounds.....	3,466 and 8,274 pounds.
Strawberries.....	Mexico, 45 and 282 pounds.....	45 and 282 pounds.
Swiss chard.....	Bermuda, 6.....	6.
Tamarinds, pounds.....	Jamaica, 452; Mexico, 140.....	592.
Tangerines.....	Argentina, 817; Cuba, 520.....	1,337.
Thyme.....	Bermuda, 2.....	2.
Tomatoes.....	Bahamas, 143,257; Chile, 20; Cuba, 160,490; Dominica, British West Indies, 6; Mexico, 1,621,255 and 104,439 pounds.....	1,925,028 and 104,439 pounds.
Turnips.....	Bermuda, 856; China, 3; Mexico, 5 and 57,103 pounds.....	864 and 57,103 pounds.
Water chestnuts.....	China, 9,980; Japan, 10.....	9,990.
Water cress.....	Mexico, 2.....	2.
Water-lily roots.....	China, 1,792; Japan, 14.....	1,806.
Watermelons.....	Chile, 838; Dominican Republic, 1; Mexico, 594,350 pounds.....	839 and 594,350 pounds.

<sup>1</sup> Includes Vinifera, hothouse, processed, and unclassified grapes.

TABLE 15.—*Fruits and vegetables imported under quarantine 56, November 1, 1923, to June 30, 1924, by countries of origin—Continued*

Kind	Country and amount	Total
Entered for immediate export:		
Garlic.....	Mexico, 25.....	25.
Ginger (crude) ..	China, 6.....	6.
Grapes, barrels.....	Italy, 6; Spain, 2,590.....	2,596.
Grapefruit.....	Bahamas, 102; Cuba, 46,175; Jamaica, 18,881.....	65,158.
Kudzu.....	China, 3.....	3.
Lemons.....	Italy, 59,811.....	59,811.
Lily bulbs (edible).	China, 1.....	1.
Onions.....	Belgium, 396; Egypt, 45,543; Italy 2,665; Mexico, 645; Spain, 2,254.....	51,503.
Oranges.....	Cuba, 11; Jamaica, 249.....	260.
Pepper.....	Mexico, 384.....	384.
Pineapples.....	Cuba, 13,588.....	13,588.
Tomatoes.....	Mexico, 150,735.....	150,735.
Water chestnuts.....	China, 1.....	1.

TABLE 16.—*Fruits and vegetables imported under quarantine 56, exclusive of Canada, November 1, 1923, to June 30, 1924, by ports of entry*

[Figures indicate a combination of crates, cases, boxes, packages, casks, bags, and bundles, unless otherwise designated]

Kind	Port and amount	Total
Apricots.....	New York, 1.....	1.
Artichokes.....	New York, 49.....	49.
Asparagus.....	New York, 795; El Paso, 5 pounds.....	795 and 5 pounds
Avocados.....	New York, 6,008.....	6,008.
Ayales.....	Nogales, 2.....	2.
Bananas, bunches.....	Baltimore, 1,557,700; Boston, 1,336,255; Galveston, 420,845; Key West, 16,474, Miami, 35,218; Mobile, 1,702,000; New Orleans, 12,447,359; New York, 9,055,128; Norfolk, 43,673; Philadelphia, 2,772,290; Tampa, 9,736; Eagle Pass, 293; El Paso, 1,389; Laredo, 695; Los Angeles, 18,993; Nogales, 1,568; San Francisco, 300.....	29,419,856.
Beans:		
Fava.....	New York, 3,576.....	3,576.
Lima.....	El Paso, 69 pounds; Key West, 26; New Orleans, 160; New York, 48,068; Nogales, 2.....	48,256 and 69 pounds.
String.....	Eagle Pass, 40 pounds; El Paso, 1,936 pounds; Key West, 25; Laredo, 240 pounds; New Orleans, 6; New York, 125; Nogales, 889 and 4,578 pounds.....	1,045 and 6,794 pounds.
Beets.....	Eagle Pass, 480 pounds; El Paso, 59,679 pounds; New York, 28,241; Nogales, 1,502 pounds.....	28,241 and 61,661 pounds.
Burdock.....	Seattle 14.....	14.
Cabbage.....	Eagle Pass, 142 pounds; El Paso, 60 pounds; Laredo, 1,160; New Orleans, 260; New York, 50,267; Nogales, 664 and 2,180 pounds.....	51,191 and 3,542 pounds.
Carrots.....	Eagle Pass, 638 pounds; El Paso, 115,919 pounds; New York, 190,596; Nogales 2 and 1,758 pounds.....	190,598 and 118,315 pounds.
Cassava.....	Key West, 225; New York, 1,077; Tampa, 45.....	1,347.
Cauliflower.....	New York, 197; Nogales, 85.....	282.
Celery.....	El Paso, 436 pounds; New York, 32,903; Nogales, 4 and 19 pounds.....	32,907 and 455 pounds.
Chayotes.....	El Paso, 1,703 pounds; Key West, 1; New Orleans, 170; New York, 331; Tampa, 4.....	506 and 1,703 pounds.
Cherries.....	New York, 1,647.....	1,647.
Cipolline.....	Boston, 204; New York, 28,016; Philadelphia, 2.....	28,222.
Crosnes.....	New York, 432.....	432.
Cucumbers.....	Key West, 274; New York, 3,376; Nogales, 15,785 and 1,255 pounds.....	19,435 and 1,255 pounds.
Dasheens.....	Boston, 63 and 1,650 pounds; Calexico, 88; Key West, 253; Los Angeles, 270; New York, 1,474; Portland, Oreg., 12; Providence, 742; San Francisco, 6,073; Seattle, 1,656; Tampa, 347.....	10,978 and 1,650 pounds.
Eggplants.....	Key West, 664; Los Angeles, 2; New Orleans, 7,762; New York, 73,586; Nogales, 8,931 and 223 pounds.....	90,945 and 223 pounds.
Endives.....	New York, 57,147.....	57,147.
Fennel.....	New York, 296.....	296.
Garbanzos, pounds.....	El Paso, 10.....	10.
Garlic.....	Boston, 835; Eagle Pass, 60 pounds; El Paso, 25,059 pounds; Laredo, 911 and 1,905 pounds; New Orleans, 1,076; New York, 6,261; Nogales 386 and 634 pounds; Philadelphia, 795.....	10,264 and 27,658 pounds.
Ginger (crude).....	Boston, 28; Los Angeles, 26; New York, 377; Portland, Oreg., 3; San Francisco, 2,218; Seattle, 245.....	2,897.



TABLE 16.—*Fruits and vegetables imported under quarantine 56, exclusive of Canada, November 1, 1923, to June 30, 1924, by ports of entry—Continued*

Kind	Port and amount	Total
Grapes <sup>1</sup> .....	Baltimore, 1,410; Boston, 110,884; New York, 510,175; Philadelphia, 4,736; Seattle, 44.	627,249.
Grapefruit.....	Boston, 92; New York, 29,271; Philadelphia, 2.....	29,365.
Horseradish.....	Boston, 720; New York, 23,224; Philadelphia, 768.....	24,712.
Kale.....	New York, 8,671.....	8,671.
Kohl-rabi.....	New York, 17.....	17.
Kudzu.....	Boston, 56; Los Angeles, 63; New York, 296; San Francisco, 455; Seattle, 119.	989.
Lemons.....	Boston, 4,381; Laredo, 110 pounds; New Orleans, 79,644; New York, 334,142; Nogales, 897 and 4 pounds; Philadelphia, 756; Providence, 101.	419,921 and 114 pounds.
Lettuce.....	Eagle Pass, 270 pounds; El Paso, 18,973 pounds; New York, 4,388; Nogales, 183 and 6,113 pounds.	4,571 and 25,356 pounds.
Lily bulbs (edible).....	Boston, 26; Los Angeles, 1; New York, 136; San Francisco, 118; Seattle, 37.	318.
Limes (sour).....	Brownsville, 50; Eagle Pass, 95; El Paso, 14,721 pounds; Laredo, 1,900 and 261,256 pounds; Los Angeles, 803; New Orleans, 1,286; New York, 18,423; Nogales, 210 and 776 pounds; San Francisco, 401.	23,168 and 276,753 pounds.
Melons.....	Brownsville, 500; New York, 13,077; Nogales, 138,868 and 2,290 pounds.	151,945 and 2,790 pounds.
Mint.....	El Paso, 1,741 pounds; New York, 236.....	236 and 1,741 pounds.
Mustard.....	El Paso, 1,263 pounds; New York, 6.....	6 and 1,263 pounds.
Nectarines.....	New York, 81.....	81.
Okra.....	Key West, 108; New Orleans, 5,376; New York, 5,719; Philadelphia, 3; Tampa, 21.	11,227.
Onions.....	Boston, 44,393; Brownsville, 515; Eagle Pass, 4 pounds; El Paso, 151,217 pounds; Laredo, 4,923 and 570 pounds; Los Angeles, 132; New York, 632,569; Nogales, 25,094 and 58,297 pounds; Philadelphia, 200; Portland, Me., 350; San Francisco, 435; Seattle, 1,501.	710,112 and 210,088 pounds.
Oranges.....	New York, 3,677; Philadelphia, 2.....	3,679.
Pachyrhizus.....	San Francisco, 257.....	257.
Parsley.....	El Paso, 9,258 pounds; New York, 56,459; Nogales, 5.....	56,464 and 9,258 pounds.
Parsnips.....	New York, 1,997.....	1,997.
Peaches.....	New York, 10,761.....	10,761.
Pears.....	New York, 519.....	519.
Peas.....	Eagle Pass, 6 pounds; El Paso, 996 pounds; Laredo, 150 pounds; New York, 41; Nogales, 35,228 and 565 pounds.	35,269 and 1,717 pounds.
Pepper.....	Del Rio, 18; Eagle Pass, 473 and 1,545 pounds; El Paso, 261,071; Key West, 12,747; Laredo, 111 and 17,118 pounds; Los Angeles, 32; New Orleans, 1,185; New York, 143,320; Nogales, 72,885 and 1,020 pounds; Philadelphia, 2; San Francisco, 29.	230,802 and 280,754 pounds.
Pineapples.....	Baltimore, 174,018; Boston, 12,204; Detroit, 900; El Paso, 15 pounds; Key West, 749,951; Laredo, 534 pounds; Los Angeles, 28; New Orleans, 55,973; New York, 290,772; Nogales, 50 and 16 pounds; Philadelphia, 2; Providence, 2; Tampa, 3,542.	1,287,442 and 565 pounds.
Plantains, bunches.....	Boston, 6; Key West, 35,000; Miami, 1,250; New Orleans, 93,101; New York, 26,805; Tampa, 44,945.	201,107.
Plums.....	New York, 2,640.....	2,640.
Potatoes, barrels.....	New York, 32,804.....	32,804.
Pumpkins.....	Brownsville, 25; Eagle Pass, 107 pounds; El Paso, 50 pounds; Key West, 54; New York, 3; Nogales, 710; Tampa, 44.	536 and 157 pounds.
Quince.....	New York, 50.....	50.
Radishes, pounds.....	Eagle Pass, 1; El Paso, 8,578; Nogales, 672.....	9,251.
Romaine.....	New York, 6.....	6.
Shallots.....	New York, 19.....	19.
Sorrel.....	New York, 37.....	37.
Spinach.....	Eagle Pass, 15 pounds; El Paso, 31,707 pounds; New York, 44; Nogales, 1 and 1,359 pounds.	45 and 33,081 pounds.
Squash.....	Eagle Pass, 15 pounds; El Paso, 5,839 pounds; Key West, 23; New York, 3,037; Nogales, 406 and 2,420 pounds.	3,466 and 8,274 pounds.
Strawberries.....	El Paso, 145 pounds; Nogales, 45 and 137 pounds.....	45 and 282 pounds.
Swiss chard.....	New York, 6.....	6.
Tamarinds, pounds.....	El Paso, 140; New York, 452.....	592.
Tangerines.....	New York, 1,337.....	1,337.
Thyme.....	New York, 2.....	2.
Tomatoes.....	Del Rio, 11; Eagle Pass, 44 and 675 pounds; El Paso, 61,889 pounds; Key West, 53,522; Laredo, 1,000 and 37,293 pounds; Los Angeles, 17,610; Miami, 48,645; New Orleans, 37,506; New York, 164,343; Nogales, 1,579,206 and 4,582 pounds; San Diego, 1,700; San Francisco, 21,441.	1,925,028 and 104,439 pounds.
Turnips.....	El Paso, 56,747 pounds; New York, 859; Nogales, 5 and 356 pounds.	864 and 57,103 pounds.
Water chestnuts.....	Boston, 294; Los Angeles, 255; Milwaukee, 50; New York, 3,192; Philadelphia, 20; San Francisco, 4,581; Seattle, 1,598.	9,990.
Water cress.....	Nogales, 2.....	2.

<sup>1</sup> Includes *Vinifera*, *bothouse*, *processed*, and *unclassified* grapes.

TABLE 16.—*Fruits and vegetables imported under quarantine 56, exclusive of Canada, November 1, 1923, to June 30, 1924, by ports of entry—Continued*

Kind	Port and amount	Total
Water lily roots.....	Boston, 25; New York, 206; San Francisco, 1,267; Seattle, 308..	1,806.
Watermelons.....	Brownsville, 58,394 pounds; Eagle Pass, 50 pounds; New York, 839; Nogales, 535,906 pounds.	839 and 594,350 pounds.
Entered for immediate export.		
Garlic.....	New York, 25.....	25.
Ginger (crude).....	San Francisco, 6.....	6.
Grapes, barrels.....	Boston, 773; New York, 1,823.....	2,596.
Grapefruit.....	New York, 65,158.....	65,158.
Kudzu.....	San Francisco, 3.....	3.
Lemons.....	New York, 59,811.....	59,811.
Lily bulbs (edible).....	San Francisco, 1.....	1.
Onions.....	Boston, 8,800; New York, 42,058; Nogales, 645.....	51,503.
Oranges.....	New York, 260.....	260.
Pepper.....	Nogales, 384.....	384.
Pineapples.....	Key West, 1,850; New York, 11,738.....	13,588.
Tomatoes.....	Nogales, 150,735.....	150,735.
Water chestnuts.....	San Francisco, 1.....	1.

### IMPORTATIONS OF BROOMS AND BROOMCORN

During the fiscal year 1924 there was a marked falling off in the importation of broomcorn and brooms, as compared with the fiscal year 1923. Table 17 indicates the quantities of each imported and the countries of origin.

TABLE 17.—*Importations of brooms and broomcorn, 1923-1924*

Country of origin	Broomcorn	Brooms
Argentina.....	330 bales.....	
Austria.....		1 package.
Greece.....		1 bale.
Hungary.....		10 cases.
Italy.....	{1,797 bales.....	{287 cases.
	{2 packages.....	{1,409 bales.
Mexico.....	378 bales.....	{2 packages.
		{39 bales.
Total.....	{2,505 bales.....	{1,449 bales. <sup>2</sup>
	{2 packages <sup>1</sup> .....	{297 cases.
		{3 packages. <sup>1</sup>

<sup>1</sup> These packages contained samples.

<sup>2</sup> Includes 39 bales shipped in bond through the United States for reentry into Mexico.

### IMPORTATIONS OF OTHER RESTRICTED PLANT PRODUCTS

In addition to the foregoing record of plants and plant products the board has supervised the importation under quarantine of 11,797 sacks and 27 samples of paddy rice imported through Nogales, Ariz. In addition 1,626 additional sacks passed through that port

in bond to Canada. Under quarantine 42, 198 sacks of shelled corn from Mexico were entered and sterilized at, San Francisco, and under quarantine 39, 296 bags and two small packages of wheat and 35 bags of rye were entered. In addition, a package containing small samples of wheat and oats was imported. Sterilization was effected in each case. Cuban potatoes amounting to 4,837 crates were imported at Key West and New York, and Mexican potatoes were admitted through the ports of Douglas and Nogales, Ariz.

### TERMINAL INSPECTION OF MAIL SHIPMENTS OF PLANTS AND PLANT PRODUCTS

During the fiscal year 1924 the States of Georgia and Idaho inaugurated terminal inspection of mail shipments of plants and plant products under the authority of the act of March 4, 1915. The terminal inspection points in Hawaii, Utah, California, Mississippi, and Oregon were revised. California, Arizona, Montana, Florida, Washington, Arkansas, the District of Columbia, Mississippi, the Territory of Hawaii, Utah, and Oregon had previously, in the order named, availed themselves of the provisions of the act referred to. Such terminal inspection is carried out entirely at the expense of the States concerned and is proving of great value to the board in the enforcement of its domestic quarantines. This is especially the case with our quarantines on account of the white-pine blister rust.

**NEW AND REVISED PLANT QUARANTINES**

The following quarantines and other restrictive orders have been either promulgated or revised during the fiscal year:

**DOMESTIC QUARANTINES**

The European corn-borer quarantine, amended September 27, 1923, and revised April 23, 1924; the gipsy moth and brown-tail moth quarantine, amended August 21, 1923, and revised June 12, 1924; the pink-bollworm quarantine, amended October 8, 1923, January 17, 1924, and April 5, 1924; the Japanese-beetle quarantine, revised November 17, 1923, and April 9, 1924; and the satin-moth quarantine, amended November 7, 1923.

**FOREIGN QUARANTINES**

The European corn-borer quarantine, amended August 4, 1923, and November 30, 1923; the seed or paddy-rice quarantine, promulgated July 17, 1923; the fruit and vegetable quarantine, promulgated August 1, 1923, and amended October 23, 1923, and Janu-

ary 18, 1924; the nursery stock, plant, and seed quarantine, amended June 30, 1924; and the Canadian Christmas-tree quarantine, promulgated June 30, 1924.

**OTHER RESTRICTIVE ORDERS**

Regulations governing the importation of cotton and cotton wrappings into the United States, amended April 30, 1924.

**CONVICTIONS FOR VIOLATIONS OF THE PLANT QUARANTINE ACT**

The solicitor of the department reported during the year 56 convictions for violations of the plant quarantine act. Of these, 41 had relation to the white-pine blister rust quarantine, 3 to the Japanese-beetle quarantine, 6 to the European corn-borer quarantine, 2 to the Mediterranean fruit-fly and melon-fly quarantine, and 1 each to the gipsy moth and brown-tail moth quarantine, the sweet-potato and yam quarantine, the Mexican fruit-fly quarantine, and the nursery stock, plant, and seed quarantine. Fines aggregating \$1,463.20 and costs were imposed.











# ANNUAL REPORT OF THE DIRECTOR OF THE FIXED NITROGEN RESEARCH LABORATORY

UNITED STATES DEPARTMENT OF AGRICULTURE,  
FIXED NITROGEN RESEARCH LABORATORY,  
Washington, August 6, 1924.

SIR: I have the honor to transmit herewith the annual report of the Fixed Nitrogen Research Laboratory for the fiscal year ended June 30, 1924.

Respectfully,

F. G. COTTRELL, *Director.*

Hon. HENRY C. WALLACE,  
*Secretary of Agriculture.*

## INTRODUCTION

This is the fifth full year of operation of the laboratory and its third under the Department of Agriculture. The work of the year has, for the most part, been a direct continuation of the same problems discussed in their general aspects in last year's report. An effort has therefore been made in preparing the present report to confine the presentation chiefly to those aspects of the work which are either new or have taken on special significance as the investigations have progressed.

## THE DIRECT SYNTHETIC AMMONIA PROCESS

During the past year the investigation of the direct synthetic ammonia process was primarily concerned with the technical adaptation of the catalysts developed by the laboratory. The most satisfactory utilization of these catalysts involved difficult problems in gas purification and circulation at high pressures. Satisfactory solutions were found, however, which have resulted in a greatly simplified process. With these improvements, the cost per annual ton of ammonia production has been decreased about 50 per cent over former estimates, as,

for example, in "Report on the Fixation and Utilization of Nitrogen," War Department Document 2041, published in 1922.

The progress made during the past year in the development of the technical details of the direct synthetic ammonia process from both chemical and mechanical aspects has won for this laboratory the interest and attention of the industry and thus made it possible for the laboratory to cooperate actively with various manufacturers of ammonia. One manufacturer in particular has worked closely with the laboratory staff in the production of detailed drawings for a 3-ton-per-day plant to be located in the West, where cheap water power is available for generating electrolytic hydrogen. These drawings were commenced last January and are now very nearly completed. Fabrication of materials has been started and commencement of operation is expected during the coming winter. In the case of several other ammonia plants aid has been given regarding the design or redesign of special equipment and in the preparation of catalysts.

In connection with the work of design it was necessary to carry on some engineering research. This was particularly true of pump packing, valves, gaskets, and means of closing the ends

of the converter. The device developed by the laboratory for this latter purpose, among other things, particularly lends ease and facility to dismantling the converter.

In cooperation with the manufacturers several compressors and blowers have been tried out with the view to securing the most efficient equipment for the special requirements of the problem.

The investigation of ammonia catalysts was extended to higher pressures than have been employed heretofore. At 1,500 atmospheres, for example, nearly 80 per cent of the gas mixture was converted to ammonia on a single pass through the catalyst, and this under conditions which are of technical significance. Endurance tests on these same catalysts at high pressures reveal a performance which has not seemed possible with the contact materials and procedures reported by other investigators.

Closely associated with the investigation of the direct synthetic method for fixing atmospheric nitrogen has been the study of practical methods of hydrogen production. Any further reduction in the cost of ammonia is most likely to be the result of a lowering in the cost of producing highly purified hydrogen. For large-scale industrial purposes the utilization of water gas, natural gas, and by-product coke-oven gas probably offers the most fruitful field for exploitation. For an independent industry the water-gas method is naturally to be preferred. Furthermore, its technical development has progressed further than that of any of the other methods. For immediate needs, therefore, the attention of this laboratory has been largely directed toward the production and purification of water-gas hydrogen.

The water-gas method for hydrogen involves the use of a catalyst for converting carbon monoxide and steam into hydrogen and carbon dioxide. During the past year substantial progress has been made in the development of catalysts for this reaction. Their performance under semitechnical conditions is to be investigated during the coming year. This more complete study is being made possible by the installation of a small water-gas plant and purification system, designed to supply a nitrogen-hydrogen gas mixture to a one-quarter ton synthetic plant operated during the past year on electrolytic hydrogen.

The removal of carbon dioxide from the water-gas hydrogen has represented an appreciable item in the cost

of purifying hydrogen from this source. Several absorption methods for carbon dioxide have been under investigation. One of these has given very encouraging results and may effect a considerable simplification in the purification process.

A study of the mechanism of catalytic action has led to some interesting observations which are soon to be published. These investigations are opening up new catalyst possibilities which may lead to marked improvements in the performance of contact agents, particularly for the ammonia synthesis.

## CYANIDES

That nitrogen is fixed in the form of cyanides in the operation of the blast furnace has long been known. There is very little information, however, on the extent of cyanide formation and the feasibility of its recovery. During the past year a cooperative study was begun with the Bureau of Mines on this problem. Information of a preliminary nature was obtained on the concentration of cyanide at various levels in one blast furnace. Special experimental equipment has been designed and constructed to determine definitely the extent of cyanide formation under various operating conditions and the feasibility of cyanide recovery. This investigation is being continued.

Investigations were continued on the fixation of nitrogen by the soda ash-carbon reaction. Work was completed which appears to definitely establish the mechanism of the reactions in cyanide formation, and information was obtained on the thermal stability of sodium cyanide and sodium carbide. These results are proving of value not only in analyzing the difficulties in the commercial operation of the sodium-cyanide process, but also in the study of cyanide formation in the blast furnace. They are also suggestive of methods of improving the cyanide process as now operated. The results of these studies are being prepared for publication.

## NITRIDES

The fixation of nitrogen in the form of aluminum nitride from which pure alumina—for use in the manufacture of aluminum—and ammonia can readily be obtained has been a subject of extensive investigations in this country and abroad, but a satisfactory process has not yet been developed. This process is to be regarded essen-



tially as one for the production of pure alumina with ammonia as a by-product, or, in other words, the ammonia thus obtained would bear somewhat the same relation to aluminum as that of coke-oven ammonia to steel. During the past year the laboratory began an investigation of this problem along what appears to be a more promising line of attack than that on which most of the previous work has been spent. The method involves the production of an alloy of aluminum, its nitrification, and the hydrolysis of the nitrified product, thus producing ammonia and alumina. The nitrification of various aluminum alloys was studied and some information obtained on the hydrolysis of the material. Further investigation is necessary to determine the value of the method, and the work is being continued.

A short study was made of the preparation and properties of phosphorus nitride. It was found that this compound, which contains the highest possible concentration of two necessary fertilizer elements, nitrogen and phosphorus, is so slowly decomposed in the soil that it is not suitable for application as such to the soil. The compound can be decomposed by suitable autoclave treatment, however, yielding ammonia and phosphoric acid, but no feasible method has as yet been found for its commercial production.

### CYANAMIDE

Investigations on the utilization of calcium cyanamide as a fertilizer, both for use as such and after conversion to urea-containing materials, were made during the past year. Some information was obtained on the fertilizer value of mixtures of calcium cyanamide and basic phosphate through field experiments carried on cooperatively with the Bureau of Plant Industry. The results as yet obtained can not be regarded as conclusive and the experiments are being continued.

A number of proposed processes for producing urea and urea-containing mixtures from calcium cyanamide suitable for fertilizer use were investigated and information was obtained on which an estimate of their value can be based. In this connection a method was developed on a laboratory scale for the production of cyanamide in a free state ( $\text{H}_2\text{CN}_2$ ), which appears to have important advantages over other methods which have been

reported. This method, which also appears adaptable to large-scale operation, will, if found commercially satisfactory, be of decided importance to the cyanamide industry in furnishing the link between the raw material and the many nitrogen compounds, including urea, which can be made from cyanamide in the free state.

In connection with the cyanamide process, a brief study was made of the formation of carbide, since the principal cost of fixing nitrogen by this process is in the manufacture of the carbide. Attention was directed in particular to the feasibility of producing carbide from lime-carbon mixtures at temperatures below the fusion point of the charge. Carbide formation was found to occur at temperatures far below the fusion point, but satisfactory yields could not be obtained under practical conditions. The investigations on the cyanamide process proper, initially undertaken by the laboratory, have now been concluded and the principal results published.

### NITROGEN FIXATION BY MICRO-ORGANISMS

That bacteria in the soil fix enormous quantities of nitrogen is well known, but the manner in which they so successfully do so at atmospheric temperature and pressure has not been discovered. With the ultimate aim of gaining some idea of the mechanism by which bacteria fix nitrogen, various elements which effect the growth and fixation by these organisms have been studied during the year. The importance of certain plant extracts in stimulating the growth of *Bacillus radicumicola* has been of special consideration, with a view to determining the constituent in the extract primarily responsible for the marked stimulation. This investigation is being continued.

### OXIDES OF NITROGEN AND NITRIC ACID

Investigations on the recovery of oxides of nitrogen from gaseous mixtures obtained in the oxidation of ammonia and in the arc process of nitrogen fixation were continued. Additional information was obtained on the use of silica gel for this purpose, and through cooperation with the department of chemical engineering, Yale University, special equipment has been designed and set up for the opera-



tion on a small scale of a process of recovery which appears to be promising. It is expected that definite information on the feasibility of the process will be obtained during the present year.

Nitric acid is not only the principal form of fixed nitrogen required in the manufacture of explosives, but it is finding increased use in the chemical industry and in the manufacture of fertilizer salts. During the past year a laboratory study was made to determine the conditions under which concentrated oxides of nitrogen can be directly converted into nitric acid of practically any desired concentration. This investigation, while not entirely complete, has established quite definitely the conditions for the production of acid ranging in concentration up to 94 per cent. Since nitric acid is very corrosive to most metals, a series of corrosion tests on various metals and alloys was made under a variety of conditions to ascertain what materials are suitable for the construction of equipment required in the production of acid by the synthetic process and for handling the acid.

#### ACTIVE NITROGEN AND CHEMICAL REACTIVITY

While much of the effort of the laboratory is directed toward the investigation of problems which bear directly on the industrial development of the fixation and utilization of atmospheric nitrogen, some effort is spent in a study of the fundamental scientific principles underlying these problems.

It is of prime importance to determine the various conditions under which nitrogen can be made reactive and thus be obtained in chemical combination. The nitrogen molecule can not take part in a chemical reaction until it has been properly disturbed or excited. The laboratory has studied the various stages and modes of excitation of the molecules of nitrogen, oxygen, and of various other gases in order to render them chemically active.

In addition, the properties of the excited molecules of oxygen and nitrogen which are necessary to the formation of ozone and chemically active nitrogen have been studied. The processes of reversion of these unstable substances to the normal nitrogen and oxygen have also been investigated. The work done on the explosive decomposition of ozone has a direct

application to the formation of nitric oxide in the arc process for nitrogen fixation.

It is expected that definite and important conclusions regarding the chemical reactions involving nitrogen will follow from further work along these lines.

#### COOPERATIVE WORK WITH DEPARTMENT OF COMMERCE

The laboratory has cooperated with the Department of Commerce in the survey of the nitrogen problem which is being made by the Bureau of Foreign and Domestic Commerce of that department, in connection with an investigation of essential raw materials now produced largely abroad under monopoly control. At the beginning of the year two members of the laboratory staff spent three months abroad, collecting technical and economic information on the nitrogen problem, with particular reference to the fixation and utilization of atmospheric nitrogen. The countries visited in this study were Germany, France, Italy, Switzerland, Czechoslovakia, Austria, Belgium, Holland, England, Norway, Sweden, and Denmark.

A part of the information thus obtained, together with information on other phases of the subject obtained through other channels, is being published by the Bureau of Foreign and Domestic Commerce, as a series of bulletins under the title of "Nitrogen Survey." For the information of those interested these reports are listed below and may be obtained from the Chemical Division, Bureau of Foreign and Domestic Commerce, Department of Commerce.

##### PART I. The Cost of Chilean Nitrate.

By H. Foster Bain and H. S. Muliken. Trade Information Bulletin No. 170. 66 pp. Issued January 7, 1924.

##### PART II. General Review of the Nitrogen Situation in the United States.

By Harry A. Curtis. Trade Information Bulletin No. 226. 63 pp. Issued May 5, 1924.

##### PART III. The Air-Nitrogen Processes.

By J. M. Braham. Trade Information Bulletin No. 240. 41 pp. Issued June 16, 1924.

##### PART IV. The Nitrogen Situation in Various Countries in Europe.

By Harry A. Curtis and Frank A. Ernst. (In course of preparation.)

##### PART V. Nitrogen Bibliography. (In course of preparation.)

# LIST OF PUBLICATIONS FROM THE FIXED NITROGEN RESEARCH LABORATORY

[Chronologically arranged for the fiscal year 1923-24]

Deterioration of Steel and Wrot Iron Tubes in Hot Gaseous Ammonia. By J. S. Vanick. Trans. Amer. Soc. for Steel Treating IV, No. 1, July, 1923.

Analysis of Hydrogen for Traces of Nitrogen. By R. L. Dodge. Jour. Amer. Chem. Soc., 45, No. 7, July, 1923.

Preparation of Dicyanodiamide from Calcium Cyanamide. By H. C. Hetherington and J. M. Braham. Jour. Ind. and Eng. Chem., 15, No. 10, October, 1923.

Determination of Nitrate Nitrogen in the Presence of Cyanamide and Some of its Derivatives. By K. D. Jacob. Jour. Ind. and Eng. Chem., 15, No. 11, November, 1923.

The Synthetic Ammonia Process of Nitrogen Fixation. By A. T. Larson. Army Ordnance Journal, IV, No. 21, November and December, 1923.

The Ammonia Equilibrium. By A. T. Larson and R. L. Dodge. Jour. Amer. Chem. Soc., 45, No. 12, December, 1923.

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OFFICE OF THE  
FOREST SERVICE  
WASHINGTON, D. C.  
1924  
FOREST SERVICE

## REPORT OF THE FORESTER

UNITED STATES DEPARTMENT OF AGRICULTURE,  
FOREST SERVICE,  
*Washington, D. C., October 13, 1924.*

SIR: I have the honor to transmit herewith a report of the work in the Forest Service for the fiscal year ended June 30, 1924.

Respectfully,

WILLIAM B. GREELEY,  
*Forester.*

HON. HENRY C. WALLACE,  
*Secretary of Agriculture.*

### NATIONAL FOREST POLICY

The report for last year sketched the broad outlines of the forest problem of the United States, in its twofold bearing upon timber supply and land use. The progress which the country has made in forestry through commercial channels as well as State and Federal activities was briefly described. The year just closed has witnessed further gains in public interest and support, in reforestation as a business undertaking by landowners, and in the growing perception of the value of forestry as a part of diversified agriculture.

As an example of many forces that are in motion, a recent development in the naval-stores industry of the Southern States is significant. Conducted along the old lines of tapping virgin timber for three or four years before it is felled or the equally temporary and more destructive exploitation of young timber, this important forest industry has steadily approached the vanishing point. A realization of this truth by its leaders led to the selection of eight naval-stores men who were designated by the Secretary of Agriculture as a commission to visit southwestern Europe for a study of the systems of forest management employed in its production of turpentine and rosin.

The report made by this commission emphasizes the merits of the forest practice in southern France, which maintains a continuous production of resinous woods and permits the almost continuous extraction of naval

stores without seriously damaging the growth of the timber or decreasing its value for lumber. The report points out the necessity of adopting the basic principle of this system—continuous timber crops and conservative methods of turpentine—in the southern portion of the United States in order to place its naval-stores industry upon a permanent footing. It will unquestionably have a marked influence upon the future handling of our southern pine lands.

The outstanding event of the year in national forestry was the enactment of the Clarke-McNary law on June 7, 1924, which takes its place with the Weeks Act of 1911 and the earlier legislation authorizing the creation of forest reserves from the public domain as a milestone of progress. For many years the efforts of the Federal Government toward the goal of forest conservation dealt largely with the timberlands in the public domain and the subsequent extension of Federal ownership to the areas where it was urgently needed in the Eastern States. To establish the national-forest enterprise as a practical and permanent public undertaking was the great accomplishment in forestry of the first two decades of this century. As a Federal activity it had to precede an attack upon the still larger task of bringing about the growing of timber on the nearly 400,000,000 acres of land not owned by the public but from which probably 80 per cent of our forest products must come in the long run. On the extension of forest



practice over these lands the country must rely largely for balancing its current consumption of timber by replacement through new growth. The Clarke-McNary Act, while confirming and expanding the policy of national-forest ownership, strikes directly at the lack or inadequacy of forest production on private land, 80 per cent of the soil in the United States which should be employed for this purpose. The new law has thus built an important enlargement into our national-forestry structure.

Commercial forces are now placing a powerful pressure behind the practice of forestry by private landowners. The two great obstacles in the path of this economic development are (1) the fire hazard to which forests are subject and (2) the danger of taxation that will make timber growing unremunerative. The Clarke-McNary law strikes at each of these obstacles, with the purpose of clearing the way so that commercial timber growing may go forward with the greatest possible momentum. It provides for nation-wide cooperation between the Federal Government, the States, and private forest owners in organized protection of all the forest lands in the United States. It extends the cooperation in this field previously afforded by the Federal Government under section 2 of the Weeks Act by removing its limitation to the watersheds of navigable streams and by crediting private expenditures for forest protection which are made in pursuance of State laws and under State supervision in the division of cost between the Federal Government and the States. The Federal Government will approve the essential requirements in fire organization and protection methods to be followed by the cooperating States, in order to insure efficiency in accomplishing the objects of the national policy. One of these requirements will be uniformly that areas containing young forest growth shall be protected as fully as tracts of merchantable timber, since the primary object of the law is to increase the production of wood for future requirements. An appropriation of \$2,500,000 annually is authorized for forest protection, which it is estimated represents about one-fourth of the cost of adequately safeguarding the State and private lands of the country from fire.

A second feature of the new act provides for a comprehensive study of forest taxation, in cooperation with the States and other appropriate agen-

cies, and devising tax laws adjusted to the economic needs of timber growing. The prevailing system of property taxes, as applied to forests, results in the continuous taxation of timber in all stages of growth and piling up a heavy financial burden upon forest production long before it yields a return. Such taxation creates an obstacle, partly financial and partly psychological, in the way of private reforestation. Unless extremely moderate, as it is in some portions of the United States, it may largely defeat private reforestation. Exemptions or bonuses designed to promote timber growing where it is not economically feasible are unsound. Forestry must stand upon a solid economic footing and must pay its fair share of community revenue. The problem is rather one of adjusting the methods of taxation to the long-time nature of timber crops so as to permit landowners to take advantage of an economic opportunity where it exists.

The solution of this problem will require an extended investigation of the present methods of taxing forest lands and their results in actual practice. The problem must be approached in the light of the existing economic conditions in the various forest regions of the United States, of the trends in land use and land ownership, and of the regional needs in fitting timber growing into the most effective use of land. A survey of the past and present efforts to remedy the situation which have been made by a number of States will be one of the first steps. The study will be localized to a large extent and will involve cooperation with local agencies in devising the best solution for the particular conditions existing in each forest region.

Two additional features of the Clarke-McNary Act seek to bring about (1) forest planting on farm lands suitable for growing timber and (2) the practical instruction of farmers in forestry. Both are directly in line with the national movement to make timber a staple farm crop and timber growing a profitable adjunct of agriculture. Fifteen States now maintain forest nurseries, from which small trees are furnished at actual or nominal cost to farmers and other landowners desiring to plant them. A considerable number of State agricultural colleges and extension services employ forest experts for rural educational and demonstration work in timber planting, the care of wood-

lands, and other phases of farm forestry; and this activity on the part of State agencies is rapidly expanding. Both of these developments will be given marked impetus by the participation of the Federal Government. An appropriation of \$100,000 for each of the purposes is authorized, which will be expended in cooperation with State agencies for expanding the activities which seek to increase timber production on our farms.

The importance of this phase of national forestry can hardly be overestimated. One hundred and fifty million acres of forest land, nearly one-third of the total in the entire country, is in farm holdings. The farms include an enormous acreage of idle forest land which now yields practically no income to its owners. The abandonment of cultivation on many farms in the humid portions of the United States has thrown annually many hundreds of thousands of acres into unemployment, most of which can be utilized profitably for timber production. A large proportion of the timber consumed in the United States has been furnished by our farms; and the practice of forestry has probably made more headway among farmers than any other class of landowners. The activities provided by the new legislation will accomplish much in making forestry part of the farm practice in the United States, as it is in all of the countries of western Europe, to the benefit alike of the farmer, the rural community, and the national timber supply. This development is in line with the action taken by the department during the past year in employing an expert in forestry on the staff of its extension service, to serve as a Federal leader in rural educational work in this field. The funds appropriated by the Clarke-McNary Act will be expended in cooperation with both the agricultural extension services of the respective States and the State forestry departments.

In the nature of things the progress of the United States in forestry is bound to be a long pull extending over many years before results in anywise commensurate with the needs can be attained. The fundamental things which we are seeking are to offset our consumption of timber by current forest growth and to employ profitably in this enterprise all of the land not better adapted to other uses. In other words, forestry must become established in our national conceptions and practices of land use. We have

only just begun to do this. It requires a far-reaching evolution in old habits of land abuse and in the viewpoint and operations of the industries which utilize forest products. The further this movement is carried, the larger the number of interests enlisted in it, the more will it become not simply a Government or State function but, like agriculture, a widespread employment of land and capital in which millions of people will be engaged. One of the most encouraging signs of progress is the widening place for forestry in our national realization of exactly this fundamental economy, and especially the large numbers of people who are now thinking of forestry in terms of specific cultural operations in the woods.

On the other hand, an enormous task is still to be performed in constructive leadership. The building up of State policies in forestry and of adequate and competent State agencies backed by intelligent public sentiment in every State having important areas of forest land is one of the most important developments that should be pressed forward. A larger degree of Federal leadership, through the channels properly and legitimately open to it, is also urgent. While the States should be, to a large extent, the agencies through which forestry is made a common phase of land use, the Federal Government can be of enormous service to the States in assisting the development of State programs, in aiding financially to get important lines of work under way, and in educating public opinion on what must be done. The Federal Government can also, through its research and educational activities, greatly promote the practice of forestry by the larger industrial interests of the country which have to do with timberland and timber manufacture. The public interest in a sufficient supply of timber and in sustained land values is so vital, and the public bills, if these two aims of forestry are not accomplished, will be so great, that there is every reason for continuing national leadership on an adequate scale.

Among the immediate things for which provision should be made by the Federal Government are (1) the establishment of a definite program and fiscal policy for the extension of the national forests by purchase, and (2) a concerted drive for the elimination of waste in the manufacture and consumption of timber.

The purchase of national forests has drifted since the exhaustion of the



funds originally appropriated by the Weeks Act. While this policy has been confirmed and expanded by the recent legislation, there has been no expression of the desires of Congress as to the scale on which it should be conducted and no fiscal program such as that prescribed for Federal aid in the construction of post roads. As set forth in a later section of this report, it has thus been impossible to organize the purchase of forest lands as a well-planned business undertaking.

The elimination of timber waste, which is more fully discussed in the section dealing with research, is one of the most necessary and at the same time most practical means of alleviating our shortage of forest-grown material. The more rapidly we move in this direction the longer will our present supply of timber last and the less will be the economic and social losses resulting from an enforced curtailment of consumption. The accomplishment of this goal rests upon the forest industries and consumers of wood, but the Government itself should lead the undertaking.

#### PERSONNEL OF THE FOREST SERVICE

The foremost task of the Forest Service is the management of 157,000,000 acres of nationally owned land. The dimensions of this job have grown so steadily that the service has been forced, like Alice in Wonderland, to run at topmost speed to keep abreast of itself. Nineteen years ago, when the Department of Agriculture took over the national forests, the work was largely protection from fire, with the construction of simple improvements on a limited scale, the handling of sheep and cattle grazing, and provisions for the timber needs of settlers and local communities. The receipts from the national forests were less than \$770,000 annually. Their great bodies of merchantable timber were largely undeveloped and unmapped wildernesses. Except in limited areas, roads and trails were few and general use of the forests correspondingly small.

The continued settlement and industrial development of the national forest regions, the westward migration of forest industries, the construction of a large mileage of roads and trails, and the tremendous growth of outdoor recreation have now completely changed this picture, and the change is going on without let-up. The receipts from the national forests last year were slightly over \$5,250,000.

The cut of timber exceeded 1 billion board feet. The administration of timber now involves a considerable number of large contracts annually in connection with the establishment of new mills and heavy investments of capital, which require extended preparatory work in surveys, estimates, and appraisals and competent technical supervision of a high order to assure reforestation and a sustained yield of forest products. Recreation has become a major use of the national forests, represented by more than 10,000,000 visitors annually. The enormously greater public and industrial use of the national forests has necessarily increased their fire hazard and compelled a constant upbuilding of the protective work, not alone in numbers of men but in technical methods, equipment, and organization.

Congress has added, and the Forest Service has welcomed, one new function after another: The classification and segregation of agricultural land, the issuance of term permits for summer homes and other forms of land occupancy, the exchange of Federal land or timber for private holdings, and the construction of a comprehensive system of roads and trails. The requirements of the national forest ranges and the needs of the livestock industry, including the inflow of additional settlers at many points, has compelled a constantly greater intensity and technical development of grazing administration. The extension of forest protection and reforestation in the national forest regions has brought many demands upon the service for cooperation with State agencies and private owners in protecting adjacent areas and applying forest practice on State and private holdings.

The most critical phase of this whole development is the constantly greater demand for business and technical efficiency which it has imposed upon the personnel of the Forest Service. The duties of the average forest ranger and forest supervisor, indeed of every grade in the field and administrative personnel, have enormously expanded both in volume and variety. Forest officers who a few years ago were largely custodians of public property have become business managers, disposing of public resources on a large scale and dealing with the local public as responsible representatives of the National Government in an immense range of contacts and obligations. The technical work required of the trained foresters, lumbermen, and grazing experts in the



Forest Service has vastly increased in its demands in the degree of competency required, particularly since the stage of theory and experiment has long been passed and sound technical practice must now be applied on a large scale in the current use of resources.

How to obtain and hold properly qualified men has of necessity been the principal concern of the organization. Its problems were made exceedingly difficult by the large turnover experienced during and following the war and by the sudden rise in living costs. Particularly was this true in view of the fact that 70 per cent of the field personnel of the Forest Service was carried on an inflexible statutory roll, at rates of pay fixed many years earlier when both the requirements of the job and the living conditions attending the job were totally different.

The readjustment of salaries under the reclassification act and the extension of its benefits to field employees has greatly alleviated the adverse conditions with which the service formerly contended. It has done much to hold the more competent employees, to reduce the turnover in all grades, and, in connection with the elimination of the statutory roll, to enable the Forest Service to proceed aggressively in building up its personnel along the lines best calculated to conduct efficiently the work of to-day.

One of the most important requirements in this direction is to increase the number of technically trained forest and range experts and to get sound technical knowledge of forestry, range management, and other subjects more largely and more directly applied in current, everyday work on the national forests. This means not only bringing into the organization a larger proportion of men of adequate school training, but more effective instruction and field training of the men now in the service and of others who will enter it through the nontechnical grades.

Although the actual work of the service dealing with public timber resources has been steadily growing, the number of its employees trained in forestry fell off sharply for a considerable period. The strongest force of forest examiners and assistants which the service ever mustered was 229, in January, 1914. Military service, losses to outside employment, and the necessity of meeting higher wage scales in employing the summer protective force, as well as the increased

cost of practically all supplies and equipment, reduced this number to 102 at the end of 1918. Every possible effort has been made to restore the quota of such employees, whose loss was keenly felt in handling current work and in the shortage of qualified men for filling vacancies in the more responsible positions. At the end of 1919 the number stood at 138; and on July 1, 1923, it had reached 152. New appointments made possible during the current fiscal year have brought the total number up to 186, still short by over 40 men of the force which was employed 10 years ago. The employment of men trained for technical work in range administration has passed through a somewhat similar cycle.

An efficient force of officers qualified by training and experience to handle the growing use of timber resources in the national forests is one of the most vital needs of the Forest Service to-day. This involves particularly the skilled supervision of cutting operations so as to insure good forest practice on the constantly growing acreage of active sales. The cost of increasing the force of men engaged in this activity will be repaid several times over by the returns in timber sale receipts. If the force can not be increased to keep pace with the demand, the only alternative will be to curtail the expansion in timber business to the sales that can be properly supervised with the number of men available. The same situation essentially exists in the utilization of the grazing resources on the national forests, where again a constantly larger degree of expert technical direction is necessary. Aside from increasing the number of employees in the technical grades, a plan is being worked out under which it is hoped that a proportion of the vacancies in the ranger grades from year to year can be filled by men of technical training in order to strengthen the field work of the Forest Service in its many technical phases.

Another essential development to attain the same end is a systematic program for the instruction of the field personnel. The ranger force includes a large proportion of high-grade men whose qualifications for their daily work can thus be materially increased. Their instruction should cover not only the fundamentals of such subjects as forestry and range management which are required in many phases of the ranger's

work, but particularly the technique of forest protection. Every fire season, such as the serious one just closed, brings to light instances where loyal and energetic men dealing with emergency conditions have made mistakes of judgment or errors in the direction of fire-fighting operations. The protection of the national forests involves many different factors of preparedness, equipment, the right use of the temporary force of guards, the organization and provisioning of fire-fighting crews, and the best methods of attack in dealing with fires under varying conditions of climate, topography, and cover. All of these things constitute a science in itself, a science not written in books but nevertheless well developed in the aggregate experience of the Forest Service as well as of other agencies.

The existing field organization of the service can be made much more efficient in preventing destructive forest fires and reducing fire expenditures if given systematic training in the essentials of this work. Every effort to afford such training is now being made, through publications, group conferences of forest officers, and the instruction of men on the job by their superior officers. Nevertheless the problem is not being adequately met. It is my earnest desire to provide for a number of training camps on the national forests themselves, at each of which 30 to 40 rangers can be assembled annually for instruction under the best leaders in the service for a period of six weeks. Such a system of field training would in three or four years reach a large proportion of the men who most need this aid and stimulus in their official duties. It is doubtful if any expenditure of funds would bring a greater return in the efficiency of Forest Service personnel as a whole.

### RECEIPTS AND EXPENDITURES

The receipts from the national forests for the fiscal year were as follows:

From the use of timber---	\$3,036,395.75
From the use of forage-----	1,915,561.49
From miscellaneous uses, including the use of land, water-power sites, etc.,-----	299,945.87
<b>Total-----</b>	<b>5,251,903.11</b>

The total is less by \$83,915.02 than that for the previous year. The receipts for the use of timber exceeded those for the preceding year by \$314,519.55, and for the use of land by \$27,489.79. These gains were more

than offset, however, by a decrease of \$425,924.36 in the receipts from grazing. The reduction in the revenues from the national forest stock ranges was due in part to delinquencies and delays in the payment of grazing fees, arising from the depression under which the livestock industry is still suffering in many portions of the West. The delinquencies for the past four years aggregate \$126,476.95, 90 per cent of which is not collectible because the grazing privileges have been abandoned, and in many cases the ranches and livestock have passed out of the hands of the permittees. Further causes of the reduction are found in the liquidation of western livestock and the drought which has prevailed in many range districts for the last two to four years.

Both factors have curtailed the numbers of stock grazing on the national forests. There were 78,000 less cattle and 120,000 less sheep on the forests in the calendar year 1923 than during the year preceding. In some cases also, reductions in the numbers of stock were made by the Forest Service to permit the recuperation of overgrazed allotments.

It is impossible to forecast when the grazing use of the national forests will be restored to its normal basis. The cut of timber and the receipts from this source may be expected to increase at a rate of 10 to 15 per cent annually, except as market depressions may check the normal expansion in sales or cut. The forest industries are steadily moving into the regions where the largest quantities of national forest timber are located.

The expenditures of the Forest Service for all purposes during the fiscal year were as follows:

General administration-----	\$261,210.32
Protection of the national forests:	
Fire prevention and detection-----	1,250,464.99
Fire suppression-----	679,896.67
Protection against insects and tree diseases-----	79,202.42
<b>Total-----</b>	<b>2,009,564.08</b>
Administration of current business on the national forests:	
Administration of timber use-----	661,566.20
Administration of grazing use-----	641,516.63
Fish and game protection-----	50,263.36
Administration of recreation and land use-----	113,185.97
Examination of power sites for Federal Power Commission-----	14,710.00
<b>Total-----</b>	<b>1,481,242.16</b>



Equipment and supplies.....	\$148,408.32
Surveys of land and re- sources:	
General surveys and maps.....	104,063.07
Grazing reconnais- sance.....	118,517.12
Timber surveys.....	202,974.90
Total.....	425,555.09
Land adjustments and ex- tensions:	
Classification, settle- ments, and claims..	92,366.96
Land exchanges.....	65,815.62
Acquisitions under act of Mar. 1, 1911.....	458,149.90
Total.....	616,332.48
Nurseries and tree plant- ing.....	196,268.41
Construction and mainte- nance of improvements:	
Construction of im- provements.....	1,177,937.76
Maintenance of im- provements.....	737,734.21
Camp ground improve- ments and sanitation.....	18,421.23
Total.....	1,934,093.20
Research:	
Silvical investigations..	185,403.40
Forest products investi- gations.....	454,181.36
Range investigations..	71,427.71
Miscellaneous investi- gations.....	60,168.63
Total.....	771,181.10
Fire protection in coopera- tion with States, under act of Mar. 1, 1911.....	398,443.18
Protection of Oregon and California grant lands.....	58,646.23
Road and trail construc- tion:	
10 per cent road fund under act of Mar. 4, 1913.....	552,140.69
Cooperative construc- tion of roads and trails under act of July 11, 1916.....	1,005,416.58
Federal forest road construction under act of Feb. 28, 1919..	273,959.73
Forest development roads and trails un- der act of Nov. 9, 1921.....	2,888,332.14
Forest highways under act of Nov. 9, 1921..	4,631,293.64
Total.....	9,351,142.78
Grand total.....	17,652,087.35

In 9 out of the last 11 fiscal years a supplemental appropriation for fire suppression has been unavoidable. The regular appropriation for this purpose will suffice only during exceptionally favorable seasons. The supplemental appropriation in 1924 for fire fighting was \$55,000. The hazardous conditions which developed in the closing months of the fiscal year, however, made this amount wholly inadequate, and the failure of the de-

ficiency bill at the end of the congressional session in June, which carried a further item to meet the emergency, left the Forest Service in a critical situation. Amounts aggregating \$61,000 were provided by transfers from other appropriations at the sacrifice of important work and through foregoing the purchase of badly needed equipment. As it was, a deficit of about \$50,000 had to be incurred for which no funds were available. The Government property must be protected from forest fires, and no other course was possible.

This situation emphasizes the need for a change in the language of the appropriation act which will make immediately available such portions of the fire fighting fund provided for the new fiscal year as must be drawn upon for May and June emergencies. Aside from obviating such a disastrous situation as that of last June, this change will remove the necessity for basing deficiency estimates in part upon forecasts of the uncertainties of the spring season whose requirements are governed largely by weather conditions. It will permit basing all deficiency estimates upon expenditures actually incurred. The deficiency system of providing for this unavoidable protection of public property, at best, has many disadvantages and handicaps. If it is to be continued this change is imperative.

### NATIONAL FOREST PROPERTIES

The net area of national forest land at the close of the fiscal year was 157,502,793 acres. The gross area, which includes privately owned and State lands lying within the boundaries, was 182,817,159 acres. The net area increased during the year 265,986 acres; the gross increased 717,357 acres, of which, however, 23,309 acres represent recomputations of existing areas based upon more exact surveys and projections.

Executive orders and proclamations and acts of Congress added 752,213 acres. Of this, 739,277 acres came through the creation of the Allegheny National Forest in Pennsylvania, which contains, however, only 73,018.74 acres that have so far been purchased. Eliminations from the national forests aggregated 58,165 acres, these being made for the most part to enable interested States having scattered tracts within the forest boundaries to surrender them in exchange for solid blocks.



Adjoining the national forests are many parcels of public domain which because of topographic, climatic, or soil conditions are chiefly valuable for growing timber. Their total area is approximately 4,500,000 acres. There are also approximately 4,000,000 acres of public land which contain timber growth suitable for fuel and posts. In addition there are approximately 1,500,000 acres of forfeited railroad-grant lands, now in public ownership, which have a present stand of commercial timber of great value and should be kept in forest production.

All of these lands should be so managed as to conserve and renew their timber resources. They logically belong in the system of national forests. The Clarke-McNary Act directs the Secretary of Agriculture to ascertain the location of public lands chiefly valuable for streamflow protection or timber production, which can be economically administered as parts of national forests, and to report his findings to the National Forest Reservation Commission. If the commission determines that the administration of such lands by the Federal Government will protect the flow of streams used for navigation or irrigation, or will promote a future timber supply, the law provides that the President shall lay its findings before Congress. To enable the Secretary of Agriculture to fulfill the obligation imposed by this law the Forest Service is now engaged in a study and classification of the areas involved. The placing under national forest administration of the forfeited railroad grant lands is the subject of proposed legislation by Congress on which the department has made a favorable report.

There are other timberlands in Federal ownership to which forest management is applicable. They comprise portions of a considerable number of military reservations and a few naval reservations, having an approximate area of 500,000 acres. Section 9 of the Clarke-McNary Act gives the President authority to establish a national forest on any portion of a reservation which, in the opinion of the head of the department now administering it and the Secretary of Agriculture, is suitable for the production of timber. The forest will thereafter be administered by the Secretary of Agriculture in accordance with regulations and plans jointly approved by the two secretaries concerned. These lands, however, are to remain subject to unhampered use for military or

naval purposes whenever required. This will allow the Government to conserve and utilize the forest growth while holding the land for military use instantly in case of need. The larger and better timbered reservations have already been the subject of cooperative study by the Forest Service and the War Department, and details for their administration are being worked out jointly.

Under the public-land grants for schools and other purposes the Western States have received, or will receive upon survey, a considerable aggregate of scattered subdivisions located in the timbered regions and not infrequently in the national forests. The States have generally come to recognize that the policy of the Government in the care and management of its timberlands is sound and should be followed by them. It is difficult, however, for them to administer small and widely-separated tracts economically. They are, therefore, taking advantage of the law under which they may exchange their scattered holdings for solid bodies of forest land. It is the policy of a number of States to administer such properties as permanent State forests, which without question will in the long run work greatly to their advantage. The Forest Service strongly encourages developments of this nature.

Satisfactory progress has been made in effecting exchanges under the act of March 20, 1922, whereby privately owned lands within the boundaries of the national forests may be exchanged for national forest land or timber of equal value. Exchanges involving 42,185 acres were appraised during the past fiscal year and have received the approval of the Secretary of Agriculture. The work has progressed rather slowly, since the Forest Service has been conservative in estimating private land values and in determining that every exchange recommended will be of positive benefit to the public interests. A large amount of data has been secured, however, which will assist service examiners in dealing with future applications. A practical method has been worked out under which the owners of small tracts are able to exchange them for timber which may be cut promptly by an operating company, thus facilitating small exchanges. A number of very desirable exchanges are now under consideration.

Some difficulty has been encountered in making exchanges otherwise desirable where the land sought lies in a

mineralized region and may later be found to contain valuable mineral deposits. In other instances lands offered in exchange, while evidently nonmineral in character, are burdened with an outstanding mineral right retained by some party in the chain of title who can not now be found. It is a common custom throughout the country for the owner of land to dispose of its mineral rights, retaining title to the surface in himself. The United States is following this practice in homestead entries which it is believed may contain valuable deposits of coal or oil. The Government has not followed this practice with respect to the so-called precious metals, although it prevails in most countries.

In purchasing land under the Weeks Act the acceptance of titles subject to outstanding mineral rights of limited duration and suitably restricted to protect the Government's control of the surface is permissible. The Government, of course, is primarily interested in the surface, since it is concerned with the growing of timber. The general exchange law does not permit conveyances of this nature by either party. A modification of the law permitting this practice would enlarge the field for desirable exchanges and would be in the public interest.

The amount made available for the purchase of lands under the Weeks Act for the year was \$450,000, the same amount as for the preceding year. That a larger sum was not available was unfortunate. There were many opportunities to buy at attractive prices. The average price paid for the lands purchased was the lowest since acquisition began, although this was influenced by the relatively large proportion of cut-over land acquired.

The purchases approved by the National Forest Reservation Commission totaled 130,290 acres. The average price was \$3.26, as against \$4.35 the preceding year, and the total obligation was \$425,256.10.

The approval of purchases by the National Forest Reservation Commission is merely the first step in the transfer of title to the United States. Control can not be assumed until title is vested through legal conveyance. The land finally acquired during the year aggregated 228,003.85 acres, and cost \$839,893.03, or an average of \$3.68 per acre. A part of this amount was obligated by purchases approved during the previous fiscal year. The distribution of the lands fully acquired, by States, is shown in Table 1:

TABLE 1.—*Acreage of timberland acquired in fiscal year 1924 and total acquired to July 1, 1924, by States*

State	Acres acquired in fiscal year 1924	Average cost per acre	Total acres acquired to July 1, 1924
Alabama.....	3, 436. 64	\$4. 65	82, 885. 84
Arkansas.....	4, 485. 28	3. 29	57, 691. 30
Georgia.....	4, 876. 91	6. 75	158, 334. 99
Maine.....			32, 255. 98
New Hampshire.....	1, 776. 39	7. 12	406, 844. 80
North Carolina.....	2, 011. 32	6. 55	350, 331. 28
Pennsylvania.....	73, 018. 74	2. 78	73, 018. 74
South Carolina.....	964. 13	5. 44	19, 522. 54
Tennessee.....	9, 046. 70	5. 13	250, 256. 49
Virginia.....	62, 215. 62	5. 11	493, 727. 44
West Virginia.....	66, 172. 12	2. 64	198, 280. 90
Total.....	228, 003. 85	3. 68	2, 123, 150. 30

The total cost of all lands finally acquired has been \$10,888,528.13 and the average cost per acre \$5.13, a reduction as compared with the average up to last year of 16 cents per acre.

No new purchase units were established during the year, but the boundary of the Natural Bridge unit in Virginia was modified on July 1 so as to embrace lands which are properly a part of the region which should be placed under protection. This change adds 134,663 acres to the unit.

The amendment of the Weeks Act by section 6 of the Clarke-McNary Act authorizes the acquisition of cut-over or denuded lands within the watersheds of navigable streams when necessary either for regulating the flow of such streams or for the production of timber. The purpose of this amendment was to extend the acquisition of national forests into the large cut-over regions of the Lake States and the southern pineries where enormous areas of denuded or largely denuded land occur whose restoration to productive forests will be slow and difficult. It is thus designed to exert national leadership in an exceedingly important phase of conservation.

Preliminary studies have been made of cut-over timber lands in Texas, Louisiana, Mississippi, Alabama, Georgia, and Florida, and several areas where purchases under the new legislation would be desirable have been located. Further work of this nature is contemplated in the Lake States. It is believed that the national forest system should ultimately include not less than 5,000,000 acres of logged-off land located in key tracts in these two regions, which should form the main source of future coniferous timber for the Eastern States.



The National Forest Reservation Commission has again recommended an annual appropriation of \$2,000,000 for land purchases under the Weeks Act. The amendment of this law, whereby lands may be acquired primarily for the production of timber, will of course widen the scope of the commission's work. Conditions are favorable at this time for the economical acquisition of desirable lands. It is urgent that Congress establish a fiscal policy governing the scale of this work, which has been carried on under varying annual appropriations without such a policy during the last eight years. This is needed to permit a proper organization of the enterprise in its various stages of field examinations, appraisals, options, etc., and to adjust the overhead to a scale of operations designed throughout to attain certain specific objectives. The acquisition of land can not be conducted efficiently by fits and starts. It should be a sustained and well-organized undertaking extending over a period of years.

The use of small tracts of national forest land under special-use permits continues to increase. At the end of the year 28,649 of these permits were in effect, of which 14,700 were subject to a small annual rental charge, while 13,949 were issued free. The lands are used for a great variety of purposes, among the more important being hotels, resorts, summer residences, drift fences, pastures, reservoirs, and water conduits.

#### NORTHERN PACIFIC LAND GRANT

A resolution of Congress, approved June 5, 1924, directed the Secretary of the Interior to withhold an adjustment of the land grant to the Northern Pacific Railway and the issuance of further patents to this company until March 4, 1926. A joint committee was created to make a complete investigation of the land grants to the Northern Pacific and report its recommendations to Congress. The occasion for this resolution, which was recommended by the Secretaries of Agriculture and the Interior and by the President, was the claim asserted by the Northern Pacific Railway to approximately 3,000,000 acres of land which for many years have been included in, developed, and administered as parts of the national forests in the Northwestern States, a property having a value of probably \$30,000,000.

These lands are situated within the so-called indemnity limits of the grant to the Northern Pacific, and are now claimed by the railroad under certain decisions of the Supreme Court, as necessary to satisfy a possible insufficient acreage secured by the company within the limits of the grant.

The grant of 1864 to aid the construction of the Northern Pacific Railway conveyed approximately 40,000,000 acres of Government land, and from it sales aggregating \$136,000,000 have been made by the Northern Pacific up to 1917. Without the slightest desire to deprive the railroad company of any property or values to which it is equitably entitled under the terms of its grant, the Forest Service believes that some adjustment should be worked out whereby the public can retain the lands in question as part of the national forests in which they are now incorporated. Furthermore, after a very extended study of the history and operations of the Northern Pacific grant, the service believes that the Government should not turn over a single additional acre of public land to this corporation until there has been a thorough accounting with the company covering all of its transactions, receipts, and obligations under the grant.

This grant contained conditions and covenants between the Federal Government and the Northern Pacific Railway Co., under which mutual obligations and commitments were assumed. The investigation of the Forest Service has disclosed many instances in which Federal lands appear to have been erroneously secured by the railroad company or in which the company appears to have failed to carry out its contract with the United States. Only action by Congress can finally settle the merits of these questions; but the importance of the issue and the values at stake are so great that the Forest Service would have been negligent of its duty had it failed to bring the matter to the attention of the two departments concerned and of Congress. The threatened inroad upon the national forests is the most serious that has menaced them since their creation; and nothing short of a comprehensive inquiry by Congress with an opportunity to pass legislation before these lands are lost to the Government will suffice to protect the public interests involved.



## FOREST PROTECTION

PROTECTION OF THE NATIONAL  
FORESTS FROM FIRE

The number, size, and causes of the fires on the national forests in the calendar year 1923, as compared with those of the two previous years, are shown in Table 2. In the classification of causes fires due to transient visitors were formerly included under the designation "campers," but sub-

the number of fires in 1923 was less by 16.8 per cent, the cost of fighting fires was less by 61.3 per cent, and the damage on national forest lands was less by 80.6 per cent.

Comparatively few serious fires occurred during July and August, ordinarily the period of high fire hazard on the western forests. This was due to frequent rains in all the national forest districts. In May and June conditions had been critical in Minnesota and in the East, and in Septem-

TABLE 2.—Comparison of fires on national forests, calendar years 1921, 1922, and 1923

Classes and causes of fire	Number of fires			Percentages of total		
	1921	1922	1923	1921	1922	1923
Class of fire:						
Burns less than 0.25 acre	2,947	3,069	2,514	50.37	48.14	48.65
Burns between 0.25 and 10 acres	1,606	1,840	1,317	27.45	28.86	25.48
Burns 10 acres and over	1,298	1,466	1,337	22.18	23.00	25.87
Total	5,851	6,375	5,168	100.00	100.00	100.00
Causes of fire:						
Railroads	643	381	234	10.99	5.98	4.53
Lightning	1,451	2,323	2,052	24.80	36.44	39.71
Incendiarism	562	870	954	9.60	13.65	18.46
Brush burning	365	236	188	6.24	3.70	3.64
Lumbering	156	156	148	2.67	2.45	2.86
Campers <sup>1</sup>	1,738			29.70		
Camp fires		843	539		13.22	10.43
Smokers		1,110	858		17.41	16.60
Miscellaneous and unknown	936	456	195	16.00	7.15	3.77
Total	5,851	6,375	5,168	100.00	100.00	100.00

Calendar year	Total area of national forest land burned over	Total damage of national forest land burned over	Total cost of fighting fires, exclusive of time of forest officers
1921	<i>Acres</i> 376,208	\$212,182	\$454,099
1922	373,214	494,965	607,200
1923	263,848	180,544	276,598

<sup>1</sup> Beginning with the calendar year 1922 this classification heading was replaced by the two following in the list.

sequent to 1921 have appeared under the two heads of "camp fires" and "smokers."

The fire season of 1923 was one of the most favorable that the Forest Service has ever known. The average annual number of fires in the 10 years immediately preceding 1923 was 6,214, the average damage on national forest land was \$929,204, and the average cost of fighting fires, including guard and ranger labor, was \$825,449. As against these averages for 10 years,

ber and October fires were numerous in the Pacific Coast States in consequence of an extended dry spell. The generally favorable weather conditions during most of the year account for the disparity between decrease in the number of fires and in the damage to forest resources and cost of suppression. Nevertheless, the widespread effort by every available means to impress upon the public the need for care in the use of fire is having an appreciable effect upon the number

of man-caused fires on the national forests.

In sharp contrast with the preceding year, the fire season of 1924 has been one of the most critical in the experience of the Forest Service. Many of the national forest regions of the West entered the spring months with a shortage of 30 per cent or more in precipitation. Fires occurred in the national forests of southern California as early as February. In most of the national forest districts conditions became hazardous and emergency forces had to be employed by the middle of May when the inflammability of the forest and brush areas was as great as ordinarily at the end of the summer dry period.

Fortunately in the Northwestern States and in the northern Rocky Mountains the emergency conditions did not continue unbroken. Rains in late July, though insufficient to terminate the general drought, gave temporary relief and enabled the largely augmented field organization of the service to bring all fires under control without serious losses. Further light showers in these districts in the latter part of August, following another period of low humidity and high winds, again checked the hazard and enabled the fire fighters to master the situation.

In the greater part of California, however, there was no rain from the middle of April until light showers fell at a few points in the northern part of the State late in August, and no real break in the hazardous fire weather until more extended rains occurred during the first week of October. The inflammability of the forest and brush areas of California was greater this year than has ever been experienced in the history of forest protection in that State; and for four months the battle with small and large blazes had but few intermissions on the majority of the national forests. Fires which burned more than a thousand acres in a single day were not infrequent.

The season on all of the national forests was practically ended by rain or cooler weather during the first week in October. The total number of fires on national forests reported up to September 30 was 7,279, exceeding the number in any previous year except 1917, when 7,814 fires occurred. Preliminary reports on the area of national forest land burned up to September 30 indicate a total of 511,396 acres, or about one-third of 1 per cent of the total acreage of Government land within the national forests.

This is nearly double the acreage burned in 1923 but is little more than half of the acreage burned in 1917, and about one-fourth of the acreage burned in 1919, these being the last two years of exceptional fire hazard. Outside of California, the losses were little if any more than the average of the preceding four years and were surprisingly small in view of the hazardous character of the season. The national forests of California, however, experienced the most serious losses in their history, aggregating approximately 337,000 acres of timber and brush land. The loss of merchantable timber was relatively small. Of the total of 7,279 fires which occurred in all the national forests up to September 30, 5,789 were extinguished before 10 acres had been burned.

A board of forest officers will shortly investigate the causes and handling of the more serious fires in California, with a view to determining both wherein the protective work of the Forest Service was not fully efficient and the lessons to be derived for strengthening the defenses in the future. The experience in that State as elsewhere has emphasized that smoking is the most serious cause of fires started by human agencies. Out of a total of 1,539 timber and brush fires in California up to September 10, 28 per cent were due to smokers and mainly to cigarette smokers. The use of manufactured cigarettes in the United States has increased by one-third during the last two years. Figures of the Treasury Department indicated that more than 6,500,000,000 cigarettes entered the channels of trade during the month of July, 1924, or nearly 750,000,000 more than in the same month of 1923. The growing use of cigarettes has created one of the most serious problems of forest protection. A considerable number of lumber companies have followed the lead of the Forest Service in prohibiting or greatly curtailing smoking by their employees in the woods. A number of county ordinances were adopted in California during the past season with the same end in view. Smoking by anyone was prohibited under a regulation of the Secretary of Agriculture on a considerable number of hazardous areas in the national forests, except at improved camp grounds or habitations. The removal or reduction of this hazard in our forest area is an essential step on which all public agencies should unite and which should enlist the active support of the forest industries and other



commercial interests which utilize forest lands.

Another of the lessons brought out by the year's experience is the need for a closer study of the other hazards which exist in or near the national forests and which may occasion destructive fires when climatic conditions are favorable to them. Such hazards do exist in many forms, such as dangerous accumulations of slash, "fire trap" sawmills or other buildings, negligently conducted logging operations, camp grounds that have not been made safe, and the like. Certain of them are difficult to eradicate. Others can be removed by an aggressive campaign of preparedness. For one thing, it is clear that more drastic Federal or State police regulations are needed to control the use of fire in the vicinity of forest areas. The need for special precautionary measures is widely recognized by lumber companies and other industrial interests, and the majority of them in the national forest regions operate with comparative safety to their own timberlands and those of their neighbors. The relatively small proportion which are out of step with the sentiment for forest protection should not be permitted to imperil the property of adjacent owners through continued negligence or indifference.

Particularly in California, and to some extent in other States, the exceptional drought compelled the Forest Service to impose restrictions upon the use of the national forests for recreation and other public purposes. This course was taken only as an emergency measure and the restrictions were adjusted as closely as practicable to the requirements in each section, so as to limit public use of the national forests as little as practicable. The measures adopted were, by and large, admirably supported by the public and met with general approval. The extent to which restrictions of this nature must be resorted to will receive earnest study in connection with the investigation of the larger fires. The very widespread recreational use of the national forests is of too great public importance to be eliminated or seriously curtailed. While every form of use of the national forests, as well as every form of land occupancy and human activity in their neighborhood, does increase the fire danger, the problem can be solved along the line of reasonable regulation and adjustment, with facilities that will safeguard against the escape of fire and with a

continuous education of the public in safe woodcraft.

Another question which will receive special consideration is how to best organize local and public cooperation, which last summer was widespread and generous, so as to function most effectively in meeting future emergencies. Los Angeles County, Calif., has a volunteer association, ready to respond with men, tools, and supplies, as a "minute-man" organization for assistance when fires occur in national forest areas, and it rendered admirable service. This is an illustration of what may be done at many other points where the local public interest in the protection of the national forests is keen. The people living in the vicinity of the national forests are learning more and more to value them and to recognize the part which they can take in protecting local resources.

For the last two years there has been no provision for meeting the cost of using army airplanes in the protection of the national forests. The airplane has, however, a valuable and important place in fire protection and for many reasons it seems preferable to expand the functions of the Air Service of the U. S. Army to include this work rather than create an independent air service under the Department of Agriculture. Airplanes are very effective for making reconnaissance flights over bad fires in order to facilitate the organization of fire-fighting operations, for following up lightning storms when often large numbers of fires are started in inaccessible localities, and for making observation flights during periods when smoke blankets greatly decrease the visibility at ground lookouts. A few machines, located at strategic points in the principal forest regions of the West, would be a valuable aid in the protection of both public and private forest resources. Some provision should be made whereby this use of aircraft can be permanently maintained and fitted into the protective organization on the national forests.

#### PROTECTION FROM INSECTS

Depredations of bark beetles continue at various points throughout the national forests, and, in so far as funds permit, the work of control is proceeding under the technical direction of the Bureau of Entomology. Unfortunately, the available appropriation is not sufficient to start control work at many places where in-



sects are destroying the timber. The southern Oregon-northern California project, for which a special appropriation of \$150,000 was made available three years ago, has been completed and the work is reported as very successful. Some further clean-up work will be necessary to hold the ground already gained, but the expenditures for this purpose will be small.

The project which has caused most concern this year, and one upon which the insects seemed to be gaining headway, is in northern Arizona, in the yellow-pine forest on the rim of the Grand Canyon. Twenty-five thousand dollars was made available for exterminating the beetles this year, but the insects spread so much more rapidly than anticipated that the amount proved to be insufficient. The open stands of yellow-pine timber in the Kaibab National Forest and the Grand Canyon National Park are one of the chief attractions of this extensive plateau region. The destruction of timber is, therefore, of large import from the recreational as well as the economic standpoint. The control work was this year chiefly aimed at the centers of infestation along the Grand Canyon highway and on the plateaus overlooking the canyon. The exact status of the project can not be given until the results of the field examination now in progress are known, but it is almost certain that a large expenditure will be called for next season.

#### PROTECTION FROM TREE DISEASES

The danger to the present and future crops of western white-pine timber from the disease known as the white-pine blister rust grew more threatening during the year with the rapid spread of the disease in British Columbia a short distance north of the international boundary. It seems inevitable that this European disease will become established in the valuable white-pine stands of northern Idaho and eventually throughout the white-pine producing region of the West. During the year the Forest Service cooperated with the Bureau of Plant Industry in efforts to devise economical methods of protection through the elimination of wild currants and gooseberries, the alternate host plants of this disease, from forested areas. Millions of dollars' worth of white pine timber and vast areas of white pine timber-growing land are involved.

The future conditions in the West are illustrated by the situation on the White Mountain National Forest of

New Hampshire, in which State the disease is well established. The area of white-pine producing land in this national forest is relatively small, but the presence of the disease made it necessary to undertake control work in the spring of 1924 and continue it through the summer. The watershed which contains the heaviest stands of white pine on the forest was covered by the currant-eradicating crew before the end of the season, and most of the remainder of the forest was scouted in an effort to determine the extent to which work is needed. Extremely helpful cooperation was received in this work from the State of New Hampshire and the Bureau of Plant Industry.

In the southern Appalachian forests a systematic effort was begun to dispose of chestnut timber before the blight ruins it for commercial use. This disease is another importation which has spread rapidly from the vicinity of New York nearly to the southern limits of the species. No practical means of controlling it has been devised. In addition to the losses of timber now merchantable, it will probably reduce somewhat the future timber production on the southern Appalachian national forests, since chestnut is one of the most rapidly growing species of the region.

#### PROTECTION OF STATE AND PRIVATE FORESTS

For 14 years the Federal Government has cooperated with States in protecting the forested watersheds of navigable streams from fire, under section 2 of the Weeks Act. During this period the number of cooperating States has increased from 11 to 28; the area protected, from 61,000,000 to 175,000,000 acres; the yearly Federal expenditure, from \$53,000 to \$400,000; and the yearly State expenditure from \$350,000 to \$1,900,000. There has also been a very large increase in the expenditures by private forest owners.

Two new States, Alabama and New Mexico, established protective systems during the year. The addition of Alabama is significant. It means the beginning of active organization for fire prevention and suppression in the Southeast, which has been slow to heed the menace of timber depletion. Similar steps to qualify for this kind of cooperation on the part of other States in the Southeast are earnestly to be hoped for, so that their remaining forest resources may be protected and their enormous area of unproductive land put to work growing the valuable

yellow pines and hardwoods for which the region is famous.

But with more States cooperating and a stationary Federal appropriation, it was unfortunately necessary to reduce again the maximum allotment that any State might receive. It was cut from the \$25,000 limit of 1922 to \$22,200. Special allotments from the contingent reserved for emergencies were made to States which experienced severe fire conditions compelling them to exceed their budgets of estimated expense. Such allotments, amounting all told to \$16,000, were made to California, Idaho, Minnesota, Oregon, and Washington.

The allotments to each State, including emergency allotments, are shown in Table 3.

TABLE 3.—*Cooperative expenditures in fire protection under the Weeks Act, fiscal year 1924*

State	Federal	State	Total
Maine.....	\$22,200.00	\$115,618.07	\$137,818.07
New Hampshire	7,304.67	42,052.44	49,357.11
Vermont.....	4,000.11	6,101.19	10,101.30
Massachusetts	8,400.00	82,083.68	90,483.68
Rhode Island..	324.35	3,537.01	3,861.36
Connecticut...	3,150.00	27,076.29	30,226.29
New York.....	22,040.44	155,707.09	177,747.53
New Jersey...	5,050.00	70,473.74	75,523.74
Pennsylvania..	13,819.32	134,775.62	148,594.94
Maryland.....	3,850.00	9,464.64	13,314.64
Virginia.....	17,981.14	17,981.14	35,962.28
West Virginia..	10,500.00	17,750.33	28,250.33
North Carolina	17,341.44	20,439.50	37,780.94
Tennessee.....	9,561.46	9,561.47	19,122.93
Alabama.....	4,050.00	4,481.66	8,531.66
Louisiana.....	21,000.00	38,166.35	59,166.35
Texas.....	17,996.73	17,996.73	35,993.46
Ohio.....	1,425.00	8,012.08	9,437.08
Michigan.....	22,163.87	241,691.76	263,855.63
Wisconsin.....	13,000.00	17,728.04	30,728.04
Minnesota.....	29,960.00	183,765.00	213,725.00
South Dakota..	100.00	6,587.00	6,687.00
Montana.....	12,384.72	14,422.06	26,806.78
Idaho.....	22,895.15	56,121.22	79,016.37
Washington...	26,390.00	66,342.07	92,732.07
Oregon.....	24,025.00	46,409.75	70,434.75
California.....	22,680.00	57,562.03	80,242.03
New Mexico...	480.00	1,177.00	1,657.00
Administration and inspection	32,406.42	-----	32,406.42
Total.....	396,479.82	1,473,084.96	1,869,564.78
Unexpended balance	3,520.18	-----	-----
Appropriation	400,000.00	-----	-----

Reports on forest fire losses which the Forest Service has been able to secure during the past eight years, though incomplete, indicate an average for this period of 41,500 fires annually, with 9,051,000 acres of forest land burned over and an immediate property loss of \$17,885,000. These losses, chiefly to timber and improve-

ments, probably represent the smaller part of the total. Much of it can not be estimated in dollars and cents for it includes, besides loss of life, the destruction of immature forests, reduction in timber growth, damage to soil fertility, wild life, and recreational possibilities, and lastly, but by no means least, the impairment of stream navigability and water-power resources.

The causes of fire were: Incendiarism, 17 per cent; campers and smokers, 16; brush burning and railroads, 14 each; lightning, 8; lumbering, 6; miscellaneous, 7; and unknown, 18. The estimated number of fires in 1923 was, in round figures, 78,800, or 90 per cent more than the average. The estimate of acreage burned was 140 per cent more than the average, and that of the property loss 55 per cent more. The increases were partly due to severe fire conditions in some regions, but partly to more complete reports from the States in the Southeast, which are fast recognizing that promiscuous burning of the woods is a real evil.

The indicated number of fires in 1923, with the damage caused and the forest land burned over in the several forest regions, is shown in Table 4. Obviously, the varying character and completeness of the data on the basis of which the totals are computed must be considered in making regional comparisons.

## NATIONAL FOREST MANAGEMENT

### TIMBER

The steady and substantial growth in the national forest timber business that has characterized recent years continued, the quantity of timber cut last year and the receipts from sales materially exceeding the record for any previous year since the national forests were established. In quantity sold the fiscal year 1924 fell below the high record established in the fiscal year 1923 by slightly more than 290,000,000 board feet; but in the calendar year 1923 sales aggregated 3,146,736,000 board feet, with a contract value of over \$9,000,000—an amount and value of new sales business which no previous calendar or fiscal year ever equaled. Compared with the calendar year 1922, this was an increase of 68 per cent in amount and 70 per cent in contract value.

The timber cut during the calendar year 1923 exceeded by 20 per cent the amount cut during 1922, and had a 23 per cent greater value. The calendar



TABLE 4.—*Summary of forest fire statistics, by groups of States, for the United States (exclusive of Alaska), 1923*

Group of States <sup>1</sup>	Number of fires		Damage		Forest land burned	
	Total	Per cent	Total	Per cent	Total	Per cent
United States (exclusive of Alaska).	78, 829	100. 0	\$27, 733, 187	100 .	<i>Acres</i> 21, 672, 114	100
Northeastern group.....	6, 244	7. 9	1, 438, 841	5. 2	277, 867	1. 3
Appalachian group.....	5, 697	7. 2	2, 195, 665	7. 9	514, 377	2. 4
Southeastern group.....	39, 621	50. 3	15, 622, 540	56. 3	16, 710, 242	77. 1
East Mississippi group.....	4, 308	5. 5	1, 174, 490	4. 2	503, 846	2. 3
West Mississippi group.....	12, 789	16. 2	2, 078, 689	7. 5	2, 139, 603	9. 9
Lake States group.....	3, 577	4. 5	2, 889, 423	10. 4	1, 259, 517	5. 8
Rocky Mountain group.....	1, 910	2. 4	234, 964	. 9	42, 809	. 2
Pacific group.....	4, 683	6. 0	2, 098, 575	7. 6	223, 853	1. 0

<sup>1</sup> Northeastern group: New England States, New York, and New Jersey.

Appalachian group: Pennsylvania, Delaware, Maryland, Virginia, and West Virginia.

Southeastern group: North Carolina, South Carolina, Georgia, Florida, Alabama, and Mississippi.

East Mississippi group: Ohio, Indiana, Illinois, Kentucky, and Tennessee.

West Mississippi group: Missouri, Arkansas, Oklahoma, Louisiana, and Texas.

Lake States group: Michigan, Wisconsin, and Minnesota.

Rocky Mountain group: Montana, Idaho, Wyoming, South Dakota, Nebraska, Colorado, Arizona, New Mexico, Nevada, and Utah.

Pacific group: Washington, Oregon, and California.

year 1923 was the first year in which the cut exceeded 1,000,000,000 feet. But in both cut and receipts the fiscal year 1924 surpassed it.

The following is a comparison of the timber business for the last two fiscal years:

TABLE 5.—*Totals of timber sold, timber cut, and receipts from sales*

Fiscal year	Timber sold	Timber cut	Receipts from sales of timber
	<i>Board feet</i>	<i>Board feet</i>	
1924.....	1, 995, 928, 000	1, 143, 638, 000	<sup>1</sup> \$2, 958, 280. 84
1923.....	2, 288, 585, 000	995, 104, 000	<sup>1</sup> 2, 641, 244. 08
1924 Increase.....	<sup>2</sup> 292, 657, 000	148, 534, 000	317, 036. 76

<sup>1</sup> Does not include receipts from turpentine sales and for timber cut in trespass or in connection with occupancy uses.

<sup>2</sup> Decrease.

This increase in national forest sales, particularly in the three Pacific Coast States where the volume of current business is heaviest, is striking evidence of the continued and increasing westward movement of the lumber industry from the cut-over regions of the East. In one instance a lumber company with its entire organization and most of its employees was bodily moved by special trains from the southern yellow-pine region to Arizona, where operations will be continued on national forest and Indian lands.

With the ever-increasing interest displayed by lumbermen in national forest stumpage and the rapid development in the volume of sales business an important problem is constantly faced by the service in keeping abreast of the demand. This relates both to the timber surveys and appraisals necessary in advance of sales and to the efficient supervision of logging operations by a competent force of trained personnel.

In point of number about 200 fewer sales were made in the calendar year 1923 than in 1922, but their average size was much greater.

The following are some of the more important tracts of timber offered for sale during the fiscal year 1924:

TABLE 6.—*Timber tracts offered for sale*

Unit	Forest	Amount, board feet
North Fork, Willamette.....	Cascade....	685, 000, 000
Frederick Sound-Thomas Bay.....	Tongass....	1334, 000, 000
Mormon Lake, etc.....	Coconino....	81, 000, 000
Dolores.....	M o n t e z u m a.	253, 000, 000
Herman Creek.....	Umpqua....	375, 000, 000
Breitenbush River.....	Santiam....	77, 500, 000

<sup>1</sup> Cubic feet.

With the exception of the Frederick Sound-Thomas Bay unit on the Tongass Forest, Alaska, the timber in each unit was awarded to the highest



bidder and a contract of sale executed. The Tongass timber comprised a pulpwood unit which was tentatively awarded to the only bidder pending the submission of a satisfactory statement of financial ability to carry out the contract.

The unit on the Cascade Forest is one of the largest bodies of timber of the Douglas fir type ever sold by the Forest Service and is valued at approximately \$1,500,000. This timber will be cut at the rate of about 50,000,000 board feet per year and will increase receipts more than \$100,000 annually. The unit embraces 15,700 acres with an estimated average stand of 44,000 feet per acre, 90 per cent of which is Douglas fir. This is the first large operation started on the Cascade Forest, which contains over 23,000,000,000 board feet of mature timber. Under the management plans for the forest, it will be possible to cut 50,000,000 feet annually from the North Fork of the Willamette drainage alone, in perpetuity.

On 17 individual forests the receipts for the fiscal year from timber exceeded \$50,000; on 9 they exceeded \$100,000; and on 3 they exceeded \$200,000. The largest amount for any one forest was \$281,488.82. These figures establish new records in timber receipts and are indicative of the extent to which this class of business may develop when other forests become more accessible than at present. The present cut is less than one-sixth of what can safely be removed annually, without depleting the growing stock or endangering future reductions in the volume of business.

The average stumpage price received in sales of timber, while governed from year to year by the accessibility and quality of the stumpage placed under contract, is gradually rising as indicated by the following record of the average stumpage price received in commercial and cost sales on the national forests for specified fiscal years: 1915, \$2.08 per thousand board feet; 1920, \$2.20; 1924, \$2.70.

TABLE 7.—Quantity and value of timber cut under sales, calendar year 1923

State	Commercial sales	Cost sales	Total	Commercial sales	Cost sales	Total
	<i>Board feet</i>	<i>Board feet</i>	<i>Board feet</i>			
Alabama.....	13, 000		13, 000	\$26		\$26
Alaska.....	44, 845, 000		44, 845, 000	75, 791		75, 791
Arizona.....	42, 031, 000	433, 000	42, 464, 000	101, 211	\$447	101, 658
Arkansas.....	6, 669, 000	142, 000	6, 811, 000	34, 132	146	34, 278
California.....	266, 624, 000	1, 834, 000	268, 458, 000	875, 769	1, 068	876, 837
Colorado.....	32, 557, 000	890, 000	33, 447, 000	85, 862	927	86, 789
Florida.....	1, 490, 000	1, 000	1, 491, 000	6, 964	1	6, 965
Idaho.....	80, 651, 000	3, 684, 000	84, 335, 000	290, 129	3, 418	293, 547
Michigan.....	60, 000		60, 000	223		223
Minnesota.....	5, 418, 000		5, 418, 000	16, 769		16, 769
Montana.....	62, 125, 000	4, 416, 000	66, 541, 000	148, 219	4, 639	152, 858
Nevada.....	1, 505, 000	206, 000	1, 711, 000	2, 029	186	2, 215
New Hampshire.....	3, 215, 000		3, 215, 000	21, 102		21, 102
New Mexico.....	23, 775, 000	737, 000	24, 512, 000	44, 712	661	45, 373
North Carolina.....	13, 784, 000		13, 784, 000	33, 542		33, 542
Oregon.....	217, 023, 000	3, 086, 000	220, 109, 000	511, 609	1, 918	513, 527
South Dakota.....	26, 605, 000	469, 000	27, 074, 000	79, 190	468	79, 658
Tennessee.....	8, 525, 000	124, 000	8, 649, 000	15, 161	133	15, 294
Utah.....	7, 022, 000	636, 000	7, 658, 000	16, 249	658	16, 907
Virginia.....	8, 490, 000	16, 000	8, 506, 000	26, 132	19	26, 151
Washington.....	142, 153, 000	506, 000	142, 659, 000	257, 754	311	258, 065
West Virginia.....	13, 000		13, 000	55		55
Wyoming.....	42, 636, 000	626, 000	43, 262, 000	93, 522	607	94, 129
Total, 1923.....	1, 037, 229, 000	17, 806, 000	1, 055, 035, 000	2, 736, 152	15, 607	2, 751, 759
Total, 1922.....	856, 147, 000	20, 826, 000	876, 973, 000	2, 218, 163	17, 333	2, 235, 496

<sup>1</sup> In addition, minor products not convertible into board feet were cut; value, \$11,317.

<sup>2</sup> In addition, minor products not convertible into board feet were cut; value, \$8,096.

TABLE 8.—Quantity and value of timber sold, calendar year 1923

State	Commercial sales	Cost sales	Total	Commercial sales	Cost sales	Total
	<i>Board feet</i>	<i>Board feet</i>	<i>Board feet</i>			
Alabama.....	26,000		26,000			\$46
Alaska.....	64,388,000		64,388,000	99,226		99,226
Arizona.....	112,015,000	482,000	112,497,000	281,360	\$523	281,883
Arkansas.....	16,850,000	161,000	17,011,000	101,795	158	101,953
California.....	457,158,000	1,810,000	458,968,000	1,205,324	1,027	1,206,351
Colorado.....	21,961,000	803,000	22,764,000	54,651	844	55,495
Florida.....	2,016,000	1,000	2,017,000	9,610	1	9,611
Idaho.....	364,499,000	3,919,000	368,418,000	1,889,196	3,750	1,892,946
Michigan.....	60,000		60,000	223		223
Minnesota.....	6,350,000		6,350,000	13,760		13,760
Montana.....	153,348,000	4,065,000	157,413,000	345,302	4,487	349,789
Nevada.....	1,415,000	211,000	1,626,000	1,941	200	2,141
New Hampshire.....	14,928,000		14,928,000	97,927		97,927
New Mexico.....	11,664,000	709,000	12,373,000	27,394	640	28,034
North Carolina.....	14,560,000		14,560,000	32,432		32,432
Oregon.....	1,515,789,000	2,621,000	1,518,410,000	3,846,664	1,841	3,848,505
South Dakota.....	36,296,000	779,000	37,075,000	133,272	729	134,001
Tennessee.....	9,722,000	146,000	9,868,000	11,555	153	11,708
Utah.....	13,035,000	928,000	13,963,000	34,499	953	35,452
Virginia.....	10,921,000	24,000	10,945,000	77,910	30	77,940
Washington.....	252,657,000	469,000	253,126,000	609,437	277	609,714
West Virginia.....	54,000		54,000	517		517
Wyoming.....	49,147,000	749,000	49,896,000	142,897	743	143,640
Total, 1923.....	3,128,859,000	17,877,000	3,146,736,000	9,016,938	16,356	<sup>1</sup> 9,033,294
Total, 1922.....	1,857,069,000	21,395,000	1,878,464,000	5,306,773	18,709	<sup>2</sup> 5,325,482

<sup>1</sup> In addition, minor products not convertible into board feet were sold; value, \$17,282.<sup>2</sup> In addition, minor products not convertible into board feet were sold; value, \$21,989.

TABLE 9.—Number of timber sales, classified according to amount of sale, calendar year 1923

State	\$100 or under			\$101 to \$500	\$501 to \$1,000	\$1,001 to \$5,000	Over \$5,000	Total
	Commercial	Cost	Total					
Alabama.....	8		8					8
Alaska.....	296		296	11	12	15	3	337
Arizona.....	821	284	1,105	4	4	7	4	1,124
Arkansas.....	33	57	90			2	4	96
California.....	553	315	868	18	6	21	14	927
Colorado.....	531	200	731	9	6	9	2	757
Florida.....	84	1	85	1	1	1		88
Idaho.....	809	1,220	2,029	14	17	13	23	2,096
Michigan.....	4		4					4
Minnesota.....	37		37	4	2	1	1	45
Montana.....	664	1,070	1,734	13	6	10	9	1,772
Nevada.....	107	75	182					182
New Hampshire.....	157		157	4	5	5	4	175
New Mexico.....	574	302	876	4		5	1	886
North Carolina.....	326		326	7	3	7	1	344
Oregon.....	338	518	856	11	5	3	8	883
South Dakota.....	305	146	451		6	14	4	475
Tennessee.....	198	51	249	4		2		255
Utah.....	340	486	826	7		6	1	840
Virginia.....	419	13	432	3	2	6	2	445
Washington.....	437	101	538	9	7	14	11	579
West Virginia.....	9		9					9
Wyoming.....	229	151	380	2	4	2	5	393
Total, 1923.....	7,279	4,990	12,269	125	86	143	97	12,720
Total, 1922.....	6,873	5,726	12,599	112	56	95	64	12,926

## REFORESTATION

The greatest agencies of reforestation on the national forests are natural reseedling and fire prevention. On enormous areas whose forest cover was wholly or partially destroyed by old

fires, 15 years of persistent protection have brought about a young growth of timber which ultimately will greatly augment the resources of the national forests. Whenever timber sales are made, the natural reseedling of valua-

ble species is provided for. But there remain about 2,000,000 acres within the national forests that were so completely denuded by old burns that artificial reforestation is unavoidable. In addition, there are about 200,000 acres in the Nebraska National Forest which are naturally treeless but on which the feasibility of timber culture by planting has been fully demonstrated.

The Forest Service is adding to the timber-growing area of the national forests by planting from 7,000 to 10,000 acres each year. In the calendar year 1923, 7,873 acres, mostly on old burns, were so restored to productiveness. At this rate, it will require over 200 years to plant the land in national forests which should be growing timber, but will not do so without artificial restocking. These Government-owned idle acres should be put to work at a much faster rate.

The work is necessarily confined by its small scale to three classes of projects:

(1) Regions where valuable timber can be most cheaply and successfully grown, such as the productive pine lands of the Lake States and northern Idaho and the productive fir lands in western Washington and Oregon.

(2) Regions where the success of tree planting has been demonstrated and there is an acute need for its extension for the protection of watersheds combined with timber production, as on the eastern drainage of the Rocky Mountains in Colorado on watersheds from which the municipal or irrigation waters are derived.

(3) Regions where the success of timber growing by planting has been established and there is special need for its extension on account of the lack of forest products in the locality and the demonstration value of planted forests, as in the Nebraska sandhills.

The largest acreage is in the first class of projects, and it is in this class especially that enlargement of the scale of operations is urgent. For example, the Michigan National Forest contains about 60,000 acres of land denuded by old fires, which can be restored to production only by planting. This national forest is near the center of population and the center of timber consumption represented by the Chicago market. Planting can be done there for less than \$4 per acre—more cheaply than on any other forest—and with excellent results in survival and growth. With the funds now available it will take over 30 years to plant these lands and restore

them to productiveness, even if it proves possible through rigid economies and slight reductions in the work in other regions, as will be attempted, to double the present rate of 1,000 acres per annum. The scale of operations on this forest should be increased to at least 6,000 acres annually, at which rate the planting can be finished in about 12 years including the time necessary to grow the larger quantity of trees in the nursery.

Similarly, on the national forests in the Appalachian region, which have been purchased under the Weeks Act, there are about 50,000 acres that need planting in order to be made productive. About 35,000 acres of this land is on the Monongahela Forest in West Virginia, where, in consolidating Government ownership, large acreages of burned spruce land have been bought by the National Forest Reservation Commission very cheaply. A small nursery with a capacity of about 150,000 trees annually has been established on the Monongahela Forest and has supplied stock for experiments which have demonstrated that planting can be done successfully and how to do it economically.

In all regions this work requires careful planning at least three years in advance. The process starts with the growing of small trees in the nurseries for from one to four years. The Forest Service now maintains seven nurseries—one each in southern Washington, western Montana, Colorado, Nebraska, Minnesota, Michigan, and West Virginia. These nurseries produce 8,000,000 to 10,000,000 small trees annually. It requires careful advance planning and technical skill of a high order to produce the small trees of the right species, size, and root development best suited for the particular area on which they are to be planted. Otherwise the work would be more costly and less successful. When ready, the trees are shipped from the nurseries to the planting sites and are put in the ground from 6 to 8 feet apart by crews of laborers supervised by rangers or other forest officers. Sudden expansions or contractions in the scale of operations are either impossible or uneconomical. The establishment or enlargement of nurseries can not be reflected in the increased acreage planted until two or three years later. Stable fiscal and administrative policies are essential. As a program for the near future, the scale of operations on the Michigan Forest should



be increased to at least 6,000 acres per annum and on the eastern forests to at least 1,000 acres per annum.

Table 10 shows the area planted during the calendar year 1923:

TABLE 10.—*Planting on national forests, by States, calendar year 1923*

State	Area planted
	<i>Acres</i>
Washington.....	1,292.00
Michigan.....	1,163.50
Nebraska.....	1,162.35
Idaho.....	1,101.00
Minnesota.....	1,009.00
Colorado.....	907.79
Montana.....	797.00
Oregon.....	322.95
West Virginia.....	110.00
New Hampshire.....	7.25
Total.....	7,872.84

## RANGE

### GENERAL CONDITIONS

Forage production on the national forest ranges in the summer of 1923 was exceptionally large in the Northwest, the more northerly portion of the Great Basin, and the central Rocky Mountain region, but on the whole was deficient in California, central and southern Nevada, western Utah, Arizona, and New Mexico.

This was the result of weather conditions. In the Rocky Mountain States from Colorado to the Canadian line and in the North Pacific States the summer rainfall was unusually heavy. In central and southern Nevada and southern Utah precipitation was below normal, and forage growth on fall and winter ranges was rather poor. In California unfavorable conditions were pronounced and feed was short both inside and outside the forests. In Arizona and New Mexico the summer rains in 1923 were spotted and late. While in places the feed was of the best, the average was below normal, and on several forests there were heavy losses from starvation, especially among cattle.

Broadly speaking, stock went into the winter of 1923-24 in fair condition. It was an unusually mild, open winter in every part of the range country. Both cattle and sheep win-

tered unusually well, and entered the forests in the spring of 1924 in fair growing condition. The summer of 1924, however, was a bitter disappointment to the stockmen of the West. A general drought prevailed over the entire range area west of the Missouri River. High temperatures with unusually scant precipitation caused the early feed to dry up, and the outlook for the fall and winter of 1924 is not encouraging.

The drought was serious in California, Nevada, Oregon, and portions of Utah, Idaho, Washington, Arizona, and New Mexico. In California it was feared that many thousands of cattle and sheep might be lost, since the quarantine prevented their removal from the State, and but little local feed was available. As is usual, however, the high mountain ranges were not affected as seriously as those in the valleys. To meet this emergency, as far as the national forests could do so, an area in the high Sierras heretofore closed to grazing on account of recreational use, was temporarily opened for 20,000 head of sheep.

### FOOT-AND-MOUTH DISEASE

Foot-and-mouth disease in California had very serious consequences for the livestock industry of that State. Upon its outbreak the district forester was instructed to cooperate in every possible way with the State and Federal authorities for its suppression. Forest guards patrolled all trails and roads leading into the forests, keeping out all livestock and nonresidents, and the disease was kept from gaining a foothold except on one forest, the Stanislaus. A herd was allowed to enter that forest from supposedly clean territory, after inspection by competent veterinarians had shown the animals to be apparently free from the disease, but before they reached their range allotment a second inspection found a number of them infected. The whole herd was at once quarantined and killed. The trail they had taken was followed back, yard by yard, and all animals that had crossed it or were found on the adjoining ranges were rounded up closely, gathered at convenient points, and destroyed. Because of the rough, broken nature of the country, burial of the slaughtered animals was a very difficult operation.

In one case where steam excavating machinery could not be moved to the spot it was necessary to herd the animals into a canyon to be shot; quicklime brought by pack horses was then spread over them and the sides of the canyon dynamited, effectively covering the carcasses with tons of rock and earth. The total number of live-stock slaughtered on this forest was 6,500 head of cattle and 3,400 head of sheep.

Because of the impossibility of rounding up every animal this forest was at once closed to all grazing uses and to the presence of domestic animals of every kind. During the winter the whole area will be covered with from 3 to 10 feet of snow, and few animals overlooked in the roundup will survive. By keeping all live-

stock out of the forest during the entire summer of 1925 and with the natural closure from snow during the following winter of 1925-26, it is expected that by the spring of 1926 the region will be effectively cleaned up so that grazing can again be permitted. During the coming winter and summer the area will be closely patrolled by State and Federal employees and every animal found will be shot and buried wherever discovered.

## USE OF THE RANGE

The number of stock grazed under permit in the calendar year of 1923 and the number of permits issued are shown in Table 11.

The cattle and sheep grazed on the national forests of the 11 Western

TABLE 11.—Grazing permits issued and number of stock grazed, calendar year 1923

State	Cattle, horses, and swine				Sheep and goats		
	Permits issued	Number of stock grazed			Permits issued	Number of stock grazed	
		Cattle	Horses	Swine		Sheep	Goats
Alabama.....	8	172					
Alaska.....	1						
Arizona.....	1,290	298,920	3,197	354	109	286,755	850
Arkansas.....	79	1,883	9	41	3	5	48
California.....	2,502	194,711	5,485	310	395	458,695	6,517
Colorado.....	3,891	332,210	6,634	25	653	845,448	1,467
Florida.....	34	817		44	3	718	5
Idaho.....	3,638	154,357	9,725		829	1,443,334	
Montana.....	2,514	148,636	11,287		384	606,247	50
Nebraska.....	41	12,140	552				
Nevada.....	445	66,816	2,832		101	291,017	50
New Hampshire.....	25	202	9				
New Mexico.....	1,967	130,059	3,305	157	430	271,516	22,372
North Carolina.....	321	1,167	52	120	27	242	
Oklahoma.....	83	3,100	452				
Oregon.....	1,768	129,325	6,088	10	443	642,605	20
South Dakota.....	712	28,002	2,477		3	5,000	
Tennessee.....	47	606	1	5	7	99	
Utah.....	6,480	151,102	6,219	281	1,780	750,971	
Virginia.....	178	1,847	17		3	86	
Washington.....	721	25,268	1,382		131	169,420	
West Virginia.....	17	120	7		4	114	
Wyoming.....	1,038	122,814	4,374		279	605,487	
Total, 1923.....	27,800	1,804,274	64,104	1,347	5,584	6,377,759	31,379
Total, 1922 <sup>1</sup> .....	30,148	1,882,491	67,856	2,149	5,811	6,497,912	36,153

<sup>1</sup> The 1922 figures here given vary somewhat from those of last year's report because they are compiled on a different basis. Those given last year represented the total number covered by permits issued. In some cases, however, the full number was not put on the forest ranges. The above figures show the number actually grazed.



range States formed the following percentages of the total number in the same States:

TABLE 12.—*Percentage of total number of cattle and sheep in 11 Western States grazed on the national forests*

State	Cattle	Sheep
	Per cent	Per cent
Arizona.....	27	25
California.....	9	19
Colorado.....	21	35
Idaho.....	22	55
Montana.....	11	26
Nevada.....	18	26
New Mexico.....	15	13
Oregon.....	15	33
Utah.....	28	32
Washington.....	5	33
Wyoming.....	14	25

Throughout the west the number of livestock is slowly decreasing; and since 1918 there has been a steady decline in the number grazed on the national forests. But 1918 was a year of abnormally high grazing use of the forests. It was the peak year of war conditions, and during the war, as an emergency measure, the forest ranges were grazed beyond their permanent capacity. In comparison with 1914, which was a normal year from the standpoint of grazing use of the forests, the use last year was greater for cattle, though less for all other classes of stock. Since grazing use by cattle or horses is estimated as five times that involved for an equal number of sheep, the total use shown in Table 13 was nearly the same in 1923 as in 1914.

TABLE 13.—*Stock grazed under permit on the national forests in 1914, 1918, and 1923*

Year	Cattle	Horses	Swine	Sheep	Goats
1923....	1,804,274	64,104	1,347	6,377,759	31,379
1918....	2,137,854	102,156	3,371	8,454,240	57,968
1914....	1,508,639	108,241	3,381	7,560,186	58,616

Far from its being true that the demand for range on the national forests is slacking down, it is fully as strong as ever. With the national forests able at present to carry only 16 per cent of all the cattle and 30 per cent of all the sheep in the 11 western range States, the demand will continue to grow. It is important to conserve and increase the carrying capacity of the forest ranges.

Under the Forest Service system of regulation, the number of those shar-

ing in the grazing privilege tends to increase. Cattle and horse permittees in 1923 were over 4,000 more than in 1914. Though about 1,200,000 fewer sheep were grazed last year than in 1914, there were nearly 400 more permittees. The falling off in sheep has affected mostly the large companies. Probably 50 per cent of the decline during the past several years has been due to the closing to sheep of numerous areas for the protection of game, recreation, city watersheds, and young forest growth. Many large companies have also been forced to cut down because of inability to secure adequate winter forage on the public domain.

On a number of forests range is being curtailed by young tree growth. Control of forest fires no doubt is the main cause of this reforestation, which, however, has been aided at many points by the regulation of grazing.

In the sheep industry the satisfactory conditions reported last year have continued and improved. Wool and lambs have brought good prices and ewes of almost every age have been in strong demand. The lamb crop for 1923 was a little above the average, and in some regions unusually high. The cattle industry, on the other hand, has remained depressed.

This has brought many requests for a change from cattle to sheep. Wherever practicable such changes will be approved. Because of the lack of a market for steers the smaller cattle owners are in many places turning to the dairy cow. The presence on the range of bulls of the dairy breeds has caused some friction with beef producers. As far as possible this has been met by furnishing the dairy interests with small breeding pastures. In other instances drift fences to keep the cattle apart on the ranges have met the difficulty.

The excellent cooperation that has prevailed between the service and its permittees has suffered from their tendency, while depression characterizes the livestock business, to drop out of their local associations. Forest officers are doing everything in their power to encourage the holding together of at least skeleton organizations, feeling sure that with returning prosperity the membership will soon build up and the associations become active.

#### LIVESTOCK LOSSES

Obviously the reduction of livestock losses on the range means larger returns to the industry as well as larger



supplies of livestock products to the public. Through the excellent work of the Bureau of Biological Survey in destroying predatory animals, losses from this cause have been materially reduced. That they are still important, however, is evidenced by the figures shown in Table 14. In Arizona and New Mexico extreme drought conditions in the summer of 1923 resulted in the loss by starvation of approximately 9,385 cattle and horses, and 3,110 sheep and goats on national forest ranges. These losses are not included in the tabular statements:

forest in the Northwest there are between 3,000 and 4,000 unclaimed horses, most of which could be kept from entering the forest if properly located boundary fences could be built. With these worthless horses off the range the allotments of cattle could be increased, which in one grazing season would bring in new grazing fees more than equal to the cost of fencing.

#### RANGE IMPROVEMENTS

Heretofore the major part of the range improvements placed on the na-

TABLE 14.—*Losses among livestock on the national forests, calendar year 1923*

District	From predatory animals		From poisonous plants		Miscellaneous causes <sup>1</sup>	
	Cattle and horses	Sheep and goats	Cattle and horses	Sheep and goats	Cattle and horses	Sheep and goats
No. 1.....	274	6,334	327	1,115	1,015	10,023
No. 2.....	212	1,110	1,623	1,710	1,422	1,534
No. 3.....	2,428	4,437	1,582	3,564	3,444	2,730
No. 4.....	179	9,443	1,466	3,303	711	11,130
No. 5.....	253	3,344	551	1,688	1,668	3,696
No. 6.....	125	8,264	113	2,773	237	5,499
No. 7.....	52	-----	6	-----	72	-----
Total.....	3,523	32,922	5,668	14,153	8,569	34,612

<sup>1</sup> Strays, bogging, diseases, lightning, flies, and like causes.

On many forests wild and unclaimed horses create a problem. Most of these animals have no value except to be slaughtered for hog and chicken feed. For this purpose they have brought as low as \$1.05 per head and seldom over \$2.50 per head above shipping costs. This does not ordinarily pay the cost of gathering on the range and driving to the shipping points. The 200 head of horses that netted \$1.05 were rather above the average weight for such animals. Most of the animals disposed of for this purpose have gone to the chicken-raising districts of central California, a comparatively small market. Attempts of forest officers to turn these unclaimed horses over to State authorities for handling under the State stray or impounding laws have been met by refusals to receive the horses because they could not be sold for enough to cover costs of handling and feeding them before disposal. A Federal statute similar to that for the disposal of stray and unclaimed livestock found on the national parks would greatly simplify this problem.

Fence construction affords another possible measure of control. On one

tional forests have been paid for by the stockmen. Owing to the financial burdens the industry is now carrying, very little has been done by the permittees in the past three years along this line. The upkeep of fences, bridges, and other important range improvements has been neglected until their physical condition is very unsatisfactory. The relatively small part of the general improvement fund that could be allotted for range improvement has been used to the best possible advantage. The upkeep alone calls for at least \$50,000 annually and in addition not less than \$200,000 should be made available in the near future for really vital work, such as boundary fences, water developments to open up new areas, and similar improvements that mean increased receipts to the Government as well as larger and better use of the range.

#### BENEFITS OF IMPROVED RANGE MANAGEMENT

The need for better range management was early recognized in national forest administration. The methods followed under uncontrolled use of

the range and commonly in effect when the forests were established proved very destructive to the forage crop. At the same time a large local industry representing thousands of established ranches and settlements was dependent upon the continuous use of these ranges. The problem confronting the Forest Service, therefore, was to install a plan of management which would not only safeguard the productivity of the forage crop but permit the economic operation of ranches dependent in whole or in part upon national forest range. The development of these plans has necessarily been a gradual process. Experiments and investigations were early initiated, the results of which coupled with careful observations of the practices of successful stockmen have been advocated and applied on national forest ranges.

The present methods followed by the Forest Service may therefore be said to combine scientific range management with the practical needs of the situation. They involve the classification of the ranges most suitable to each class of stock, the regulation of the seasons of use to meet the growth requirements of the vegetation, the proper handling of stock by riding and salting to secure uniform distribution, the improvement of ranges by the construction of trails, fences, etc., and the development of watering places.

In the application of these plans careful consideration has been given to the economic conditions in each locality and the requirements of the livestock industry. In many cases, for example, a strict enforcement of the season best suited to the range forage would materially curtail hay production on the ranches. Recognizing that hay production is quite as essential as summer pasture, every effort is made to so adjust seasons as to interfere the least with the proper use and development of ranch property, and at the same time adequately safeguard the range forage. These plans of management also give full consideration to economy of operation and ways and means by which higher returns may be secured. They include the segregation of beef from breeding stock, the improvement of herds by better sires, the reduction of losses on the range, the increase of calf crops, and more effective utilization of labor.

From study, observation, and the application of scientific principles of grazing management it has been pos-

sible to develop systems which are now freely accepted by most stockmen, such as "deferred and rotation grazing," "the open or bedding-out system of herding sheep," and "pools" in which a large number of individuals cooperate in the payment of range expenses. In practically every case in which these plans have been installed a saving has resulted to the individual or increased returns have been secured, and the range has been materially benefited. While the need of such plans is now generally recognized, the drought of the past season and the bad financial situation confronting the cattle industry has greatly retarded their application. With a gradual improvement in market conditions the Forest Service will be in a better position to carry out betterments in the handling of national forest grazing lands, to the benefit of both the range and its users.

Formerly most of the lambing on national forests was on the open ranges on special lambing grounds. This is very hard on the range, and justified the extra charge of 2 cents made for this privilege. Open-range lambing, however, is a wasteful process. Studies of it have proved beyond a doubt that lambing under sheds, where feed can be given the ewes and both ewes and lambs are sheltered, is a profitable investment for the owner. Moreover, the lambing can be two or three months earlier than on the open ranges, making it possible to market the lambs to better advantage.

Having demonstrated this, the Forest Service for several years has been withdrawing the open-range lambing privileges as rapidly as was fair to its permittees. Fully 70 per cent of the lambs now grazed on national forest ranges were lambled in sheds. This has meant large reductions in the losses of both lambs and ewes that always cut so deep into the sheepman's profits under open-range lambing methods, as well as earlier marketing. It has also meant a much more satisfactory use of the old lambing grounds.

The following examples show the value of this method of lambing. On the Cochetopa Forest, in Colorado, checks made on 32,000 sheep showed 74 marketable lambs to the 100 ewes when lambing was on the open range and 86 when it was under sheds. This increase in the lamb crop brought the owners approximately \$18,000 more than had they lambled on open range, while the comparatively small increased cost was undoubtedly balanced by the reduction in losses among the



ewes and the earlier date of the lambing. On the Beartooth Forest, in Montana, under shed lambing a permittee saved no less than 600 pairs of twin lambs from a total of 3,200 ewes. It was the owner's opinion that under open range lambing comparatively few of these twins would have been saved.

Such improvements point the road which western stockmen must follow in order to reduce costs of production. They are applicable in beef production as well as in that of wool and lambs. The average calf crop for range herds is entirely too low. On the Cochetopa Forest, in Colorado, one permittee grazing 700 head of cows was securing, under usual range methods, an average annual calf crop of about 57 per cent. By placing his cows in breeding pastures for a comparatively short season the permittee secured an 80 per cent calf crop. The increase afforded a clear profit of over \$7,500, a high return on the necessary investment in pasture lands.

#### NEW GRAZING REGULATIONS

The new grazing regulations which became effective on March 1, 1924, are working efficiently. The issuance of 10-year permits will begin January 1, 1925, and it is believed that generally speaking all needed range reductions and adjustments will have been made by that time, so that this form of permit can be issued without danger of complications. At the close of the first half of the period there will be a new adjustment of ranges, and properly qualified new Class A applications will then be approved. It is believed this form of permit will be of great aid in stabilizing the grazing industry of the national forests.

#### NEW GRAZING FEES

The new range appraisal data for the majority of the forests have been compiled and placed before the stockmen through their associations for review and criticism. There has thus far been very little criticism on their part as to the fairness and correctness of the facts used in working out the new schedule of fees. Early in January, 1924, owing to the depressed condition of the livestock industry throughout the West, the Secretary of Agriculture announced that where the new schedule reduces the present rate, it will be applied in full beginning with the season of 1925, but that no increases in fees will be made prior to the season of 1926. Should there be

a substantial improvement in the business conditions affecting the livestock industry by 1926, the right will be reserved by the Government to put the new schedule of fees into effect on a graduated scale extending over the four years from 1926 to 1929. Under this plan the new fees will not become fully operative until the opening of the grazing season of 1929, thus giving the livestock industry a fair opportunity to recover from the serious condition in which it has been for the last three years.

#### RECREATION AND GAME

The number of people visiting the national forests for recreation is estimated each year by the local forest officers. Since no actual census of visitors can be taken, the figures reported are approximations only; but they afford a fairly reliable criterion of the volume of recreation use. The total number of visitors reported last year exceeded 10,500,000. In less than 10 years the number has more than tripled.

Undoubtedly the figures represent a certain degree of duplication, since the same person may visit several forests, or the same forest repeatedly, without deduction for this in the estimate. On the other hand, there are also undoubtedly many transient visitors of whose presence the forest officers do not know. The main point is that recreational use of the forests has assumed almost staggering proportions, and is rapidly increasing. A corresponding administrative responsibility is involved.

The coordination of outdoor recreation with timber production is wholly germane to the practice of forestry, and is an essential part of any sound plan of national forest administration. To provide properly for recreational use of the national forests will, however, require substantial expenditures. Otherwise intensive use of the more attractive or accessible areas will create serious hazards to public health and property. Camping spots and places of general resort must be suitably prepared for safe occupancy. Pure water supplies; toilets; fireplaces; occasionally tables and benches; less frequently, simple shelters from the elements, or fences to exclude range stock, are in general the primary requirements. Lessened fire hazard, sanitation, and reasonable provision for the comfort of visitors constitute the reasons for these improvements.



For the average camp ground with a daily capacity of 50 people the cost of installing such simple facilities averages about \$200. To provide at this rate for the 1,500 camp grounds now in common use within the forests would require \$300,000. Progress toward the installation of such a system should be much more rapid than it has been in the past.

Some indirect costs are entailed by the use of the forests for outdoor recreation. These include more intensive provision for fire control and certain restrictions upon grazing, timber cutting, and other revenue-yielding enterprises. Progress is being made in the formulation of plans to coordinate recreation and other forms of use with a minimum of loss and special administration. Net public benefit is the governing principle. Concurrently, the revenue-yielding recreation activities are mounting steadily in volume and receipts, thus largely offsetting the costs.

Improvements constructed for other purposes lead to larger recreation use. Each new road or extension of an old road, each stretch of trail built, though primarily for fire fighting purposes, each new fire lookout perched upon some outstanding peak, means more visitors. Community use also is rapidly increasing. Towns and cities within reasonable distance seek spots upon which to locate camps and recreational areas for their citizens. For example, in Arizona two copper mining communities have undertaken the development of special areas in a thorough-going manner, the companies paying the bulk of the cost. Roads and trails, mostly of the best permanent type of construction, leading to the areas have been built. Swimming pools, tennis courts, golf grounds, and other like improvements have been placed on them by the two communities. Several of the mining companies have secured grounds upon which to construct summer cottages, to be occupied by their employees at a low rental.

The importance of the 15 national monuments located within national forests has not been adequately recognized. These monuments have been created to preserve permanently to the American people rare material or historic treasures; such as the herds of Roosevelt elk in the Mount Olympus Monument; the great caverns of the Jewel Cave, Leman Caves, Oregon Caves, and Timpanogas Caves; unique examples of earlier modes of life, such as those afforded by the Bandelier,

Gila Cliff Dwellings, Old Kasaan, Alaska, Tonto, Walnut Canyon, and Wheeler Monuments; unusual geological formations, such as those found within the Bryce Canyon Monument with its delicate beauty of rock erosion, the Devil's Post Pile with its towering basaltic pillars, and the most newly created, the Chiricahua, a fine example of rhyolitic erosion. To these may be added the Big Hole Battle Field, which, though nominally under the administration of the War Department, is taken care of by the Forest Service. Unfortunately, the lack of appropriations has made it impossible to give these important areas much more than incidental administration, or to construct upon them the improvements and facilities essential to their full use and enjoyment by the public. While acts of vandalism are not frequent, the monuments should be absolutely safeguarded against damage by any cause.

In connection with the use of the national forests for recreation, two conferences call for mention. One was the First National Conference on Outdoor Recreation, which met in Washington at the call of the President of the United States on May 22, 23, and 24, 1924. The other was the National Conference on State Parks, which met immediately afterwards at Gettysburg. These gatherings were participated in by over 400 men and women who not only are personal leaders and authorities on subjects relating to public welfare but also represent almost 200 national and State organizations with fields of service embracing all sections of the country and memberships aggregating millions of people. The conclusions reached indubitably reflect the needs and sentiments of a large part of the citizens of the country.

In these gatherings recognition was unanimous of the growing dependence of the people of the United States upon the mountain and forested lands and waterways of the country for wholesome outdoor play, and emphasis was laid upon the necessity for making public lands as generally available for this purpose as possible. Steps were taken by which the agencies participating in the conferences may hereafter cooperate more fully with the Federal Government in developing the use of the national parks, forests, and other public lands so as to best meet our recreational requirements. The creation of this organized means for public participation in the adequate development of the national forests as centers

of outdoor recreation is a great gain in national forest administration.

To national forest visitors the presence of fish in the streams and game in the hills lends an added attraction. Systematic stream stocking, with law enforcement, may be made to keep up a fair supply of fish. The perpetuation of game animals and birds, however, presents quite another problem. Hatcheries for game birds and artificial breeding grounds for game animals would entail at present a prohibitive expense. Dependence must be had upon keeping suitable and sufficient areas closed to hunting, and wherever necessary to grazing, so that refuges, natural breeding grounds, and food supply may be assured. From the protected areas the game will usually overflow into the surrounding territory.

The annual census of game animals in the several forests continues to improve as field experience in estimating is gained. At the same time information is gathered on the habits of game species and the effect of the game laws, bag limits, grazing of domestic stock, predatory animals, and similar matters. The figures for the calendar year 1923 show increases of deer in Arizona, Florida, Idaho, Montana, New Mexico, and Washington, which are believed to be due partly to a more accurate estimate.

The total for all national forests is 511,000 deer, 49,000 elk, 7,900 moose, 18,000 mountain goats, and 13,000 mountain sheep. In general the elk and deer are probably increasing in numbers, with moose, goats, and sheep holding their own. California still stands first in the number of deer with over 187,000 in the national forests of that State. Oregon comes second, with 52,000. Wyoming, as heretofore, has the greatest number of elk, 15,000. Washington comes second with 8,368, this herd being the Roosevelt elk, an animal somewhat different from the Yellowstone species.

Excluding Alaska, Idaho with 3,400 goats and Colorado with 5,600 mountain sheep are at the head of the list for those animals. Colorado's splendid record in protecting her mountain sheep proves what can be done toward preserving any species of wild game if action is taken in time and real protection is afforded. Not all the deer are in the national forests of the West. In New Hampshire there are over 10,000 head, in Minnesota over 3,000, and in Florida over 1,200. Only game animals having their prin-

cipal habitat within the national forests are included in these estimates.

Wild life is recognized as one of the major resources of the national forests. Its wise use and perpetuation are sought in accordance with the same fundamental principles which control the policies dealing with timber or forage. On forests having particularly valuable wild life resources, like the Teton in western Wyoming, which contains 8,900 elk and 1,200 moose, adequate provision for wild life should be one of the foremost objects of administration and other uses or developments subordinated to the attainment of this object.

As advocated in the resolutions adopted by the National Conference on Outdoor Recreation, the field personnel of the Forest Service cooperates with the game departments of the States in which national forests are located in the enforcement of the State game and fishing code, in the creation and protection of State game preserves, and in building up through study and observation the technical information needed for changes in State laws or other developments designed to promote the welfare of wild life. Furthermore, as the owner of the land involved and from the standpoint of the national importance of wild life conservation, the Federal Government should be prepared to supplement the activities of the State where that may be in harmony with the common program. A notable example of such measures is the winter refuge and feeding ground for the Jackson Hole elk herd, which is maintained by the Biological Survey.

The creation of Federal game preserves in national forests, with the concurrence of the State, as has been done recently in North Carolina, Georgia, and Tennessee, is another means whereby the National Government may wisely supplement State activities where local conditions lend themselves to the administration of game by the Forest Service. A comprehensive statute establishing a policy for this development and permitting the creation of Federal game preserves in national forests by Executive action, would be a very desirable step. The national forests contain a large portion of the natural habitat, in some cases the last natural refuge, of a number of America's most valuable and distinctive game animals. And with a permanent field organization now protecting and administering these areas, there is every reason for



adding to their public utility in this very important phase of conservation.

A special problem has developed on the Grand Canyon National game preserve, in northern Arizona, where a large herd of mule deer has outgrown its food supply. The area is known as the Kaibab plateau, which forms an isolated tract of well-timbered country lying immediately north of the Grand Canyon and surrounded on the other sides by a semidesert region. The desert—waterless, treeless, and lacking generally in the forage cover preferred by deer—prevents their migrating to other parts of the region, while the canyon stops their movement southward.

Under 18 years of protection the deer have increased to a number estimated at not less than 30,000, with an annual fawn crop of about 6,000. The area has become so seriously overgrazed that wholesale losses from starvation are imminent. The Forest Service has for several years recognized the approaching danger and to increase the food supply available for the deer has reduced the number of cattle permitted to graze on the same range until only about 2,500 are left. These cattle, together with about 3,500 sheep that graze the northern tip of the plateau, are owned by local settlers who could not maintain themselves and their farms if denied their present grazing privileges.

The steady increase in the deer has more than counterbalanced the reduced grazing by cattle, and the lack of forage has become yearly more noticeable. If all domestic animals were removed from the range, the crisis would be merely postponed until the deer through further increase again exceeded the carrying capacity of the area. A winter of deep snows following a dry summer like that just experienced can hardly fail to cause heavy losses from starvation.

The Forest Service and the Biological Survey have studied this situation for several years from every angle. Reduction of the deer herd is inevitable. The only choice lies between allowing this to take place through starvation and disease or applying artificial measures to maintain a balance between deer and food supply. It would seem that there could be no question as to which is preferable. The first course would mean not merely recurring famine crises by which large numbers of deer would periodically suffer lingering death, but also a

progressive reduction in the carrying capacity of the range. The second course would mean in the long run a healthier and more vigorous deer herd.

In various quarters, however, a considerable sentiment against corrective measures has found expression. To obtain an impartial outside review of the facts and an independent judgment as to the soundness of the conclusions, the Secretary of Agriculture created last February an advisory committee representing wild-life and other conservation organizations, including one representative of the western range livestock industry. The committee, all men of national reputation, themselves made a careful examination of the area and in addition held a public hearing. Their findings were confirmatory in all particulars of the facts sets forth above. With regard to the number of deer on the area, the committee believes that the department estimates are conservative. It concurred in the judgment of the Forest Service that the stock of local settlers should not be excluded from the forest, as "the limited population of southern Utah is dependent largely upon the stock for a livelihood." The report of the committee stated further:

Whatever the cause, there can be no question that the Grand Canyon national game preserve is now both overgrazed and overbrowsed. Sheep are now grazed only in a small part of the northern edge of the forest and the numbers of the cattle having been greatly reduced it is clear that the deer are the chief factors in this decrease of the food supply. \* \* \*

In the regions covered during the first five days in the game preserve almost all the deer observed were in very poor condition. At that time of the year, when the deer should be in the pink of condition, all, including even most of the large bucks, were extremely thin. \* \* \*. In considering the condition of the deer it must not be overlooked that this season has been one of severe drought, which would naturally affect the food supply. However, this drought was in no large way responsible for the vast scarcity of food over most of the preserve.

As an immediate remedy the committee believes that "no reduction of less than 50 per cent of the present herd would be effective," and therefore recommends the removal of half the herd as quickly as possible, by the following methods:

(1) The shipment of live deer to other parts of the United States for stocking other areas.

(2) If this does not secure the recommended reduction, the opening of the preserve to regulated hunting.



(3) As a last resort, destruction of deer through killing by Government officers, the meat and hides to be used to the best advantage possible considering the location, over 165 miles from the nearest railroad.

The first of these measures has been inaugurated through public announcement that live deer will be given all applicants who will pay crating and transportation charges. If this measure proves inadequate, regulated hunting will be permitted.

The committee which conducted the investigation consisted of John B. Burnham, of the American Game Protective Association; Heyward Cutting, of the Boone and Crockett Club; T. Gilbert Pearson, representing the Audubon Society and the National Parks Association; and T. W. Tomlinson, secretary of the American National Livestock Association, to all of whom are due grateful acknowledgments for valuable and disinterested service rendered at personal sacrifice. Their investigation was important not only because the handling of the Kaibab deer is in itself a question of general interest but because it presents in concrete form a vital phase of wild life management certain to arise elsewhere as time goes on.

#### WATER POWER

Of 87 applications for water-power permits or licenses received during the past year by the Federal Power Commission, 45, or about 52 per cent, involved the use of national forest land. In the four years of operation under the Federal water power act, 271 such applications have been filed, of which almost half were made in the first year. The desire for power development in California still exceeds that in any other national-forest State.

Engineering investigations and reports were requested by the Federal Power Commission on 28 applications and administrative reports in 24 cases. These are respectively 5 less and 4 more than during the preceding year. The power commission also requested the Forest Service to supervise and inspect the operation of 33 permittees or licensees under the Federal water power act, this with earlier requests making a total of 111 cases at the end of the year. In addition, the Forest Service is supervising stream gaging operations for 16 cases in Alaska.

Under the provisions of the Federal water power act, a permittee under an

earlier act may apply to the Federal Power Commission for a license or permit. When the law was enacted it was supposed that a large number of such applications would be received. While there have been some—mostly from companies desiring to change the project works or whose projects had not advanced to the construction stage—the expectation of four years ago has not been borne out. The reason for this is not entirely clear. Companies which succeeded in financing development and in starting operation under the insecure tenure of the act of February 15, 1901, seem content with their present permits. A gradual decrease in the number of Department of Agriculture permits will undoubtedly ensue, as a result of the termination of permits and of changes or extensions which can not be granted except by the Federal Power Commission. It now seems, however, that a very large proportion of the present permittees will hold their rights under this department for many years to come.

For proper utilization of the water-power resources of the Nation reliable data are essential, both on developed and especially on undeveloped power resources. The Forest Service now has good though incomplete information on the undeveloped water-power resources of the Tongass Forest. For practically all of the other national forests the knowledge at hand is very inadequate. The applications that are being made to the Federal Power Commission indicate early development of many power sites on the national forests. To secure for the public the greatest benefit from such power development the Forest Service should know the power capacity, location of power sites, cost of development, value, and probable manner of utilization. It should have such information not only for individual streams but for all streams possessing power value. A comprehensive investigation of the national forest power resources is urgently needed. For the most effective use, this investigation should have been made years ago; but since development on forest lands is only well started, it is not too late to gather data that will prevent future mistakes.

The following tabulation contains data concerning water-power permits granted by the Department of Agriculture and in effect on June 30, 1924:

TABLE 15.—*Water-power development and transmission-line rights of way under permit or easement, fiscal year 1924*

Class of permits or easements	Transmission lines only			Power projects (reservoirs, conduits and power-houses)		Total permits or easements
	Permits or easements	Within national forest boundaries	On national forest land	Permits or easements	Estimated average output at minimum discharge	
Permits or easements in force at close of fiscal year:	<i>Number</i>	<i>Miles</i>	<i>Miles</i>	<i>Number</i>	<i>Horse-power</i>	<i>Number</i>
Rental—						
Preliminary .....	147	1,084.65	789.02	3	900	3
Final .....	19	144.45	120.13	79	571,424	226
Free permits or easements .....	19			91	27,545	110
Total .....	166	1,229.10	909.15	173	599,869	339
Construction completed at close of fiscal year:						
Rental permits or easements .....	147	1,084.65	789.02	71	368,551	218
Free permits or easements .....	19	144.45	120.13	83	10,335	102
Total .....	166	1,229.10	909.15	154	378,886	320
Construction incomplete at close of fiscal year:						
Rental permits or easements .....				8	203,645	8
Free permits or easements .....				7	17,195	7
Total .....				15	220,840	15
Construction not started at close of fiscal year:						
Rental permits or easements .....				3	128	3
Free permits or easements .....				1	15	1
Total .....				4	143	4

**ROADS AND TRAILS**

During the year 1,857 miles of road and 4,805 miles of trail were constructed or improved and 7,422 miles

of road and 31,846 miles of trail were maintained. Table 16 shows the accomplishments and expenditures in detail.

TABLE 16.—Construction and maintenance of roads and trails from forest road appropriations and other Federal and cooperative funds, by States, June 30, 1924

State	Fiscal year 1924		Total to June 30, 1924				Expenditure to June 30, 1924		
	Constructed		Constructed		Maintained		Federal funds	Coopera- tive funds	Total funds
	Roads	Trails	Roads	Trails	Roads	Trails			
	Miles	Miles	Miles	Miles	Miles	Miles			
Alabama					43.0	19.0	\$11,004.18		\$11,004.18
Alaska	44.7	71.1	124.3	162.2	129.4	249.3	1,520,063.76	\$192,015.74	1,712,069.50
Arizona	88.5	244.0	539.3	1,237.8	847.9	852.7	1,707,656.39	691,396.53	2,399,052.92
Arkansas	47.3	51.8	248.5	352.4	214.7	309.7	438,798.03	25,876.19	464,674.22
California	236.7	493.6	704.1	1,679.3	1,021.1	3,872.3	4,913,539.42	1,480,153.30	6,393,692.72
Colorado	74.0	549.6	671.2	1,180.8	414.1	3,144.7	2,519,336.03	545,400.28	3,064,736.31
Florida	10.2		63.8		103.2	36.5	114,674.88	68,148.39	182,823.27
Georgia		2.0	13.5	166.6	18.5	166.6	134,825.32		134,825.32
Idaho	206.6	887.3	1,146.6	2,707.6	429.8	4,829.7	4,985,025.75	1,188,749.70	6,173,775.45
Kansas			3.4				2,111.51		2,111.51
Maine	0.7	1.3	5.0	31.3	7.6	37.0	12,473.90		12,473.90
Michigan			40.4		73.0		8,382.89	243.45	8,626.34
Minnesota	58.5	28.0	129.0	67.0	190.2	259.0	200,404.73	116,176.48	316,581.21
Montana	94.2	517.4	484.0	1,201.1	563.8	5,344.0	2,800,371.77	441,978.12	3,242,349.89
Nebraska	10.0		34.6		14.0		30,430.43		30,430.43
Nevada	83.0	159.0	372.3	499.8	109.9	220.0	429,620.11	100,263.27	529,883.38
New Hampshire	3.9	25.5	14.6	35.5	38.9	287.4	74,687.55	5,985.42	80,672.97
New Mexico	35.3	208.4	329.2	1,078.7	678.0	1,341.0	1,431,978.92	199,051.81	1,631,030.73
North Carolina	15.0	66.7	42.1	509.8	89.4	509.8	253,949.06	35,373.62	289,322.68
North Dakota			1.0				65.75		65.75
Oklahoma	13.1		19.1		11.6		27,322.55	9,644.93	36,967.48
Oregon	337.9	489.8	1,421.7	1,354.7	1,950.5	4,715.0	4,707,647.41	3,091,285.48	7,798,932.89
Pennsylvania	13.0		13.0				2,101.36		2,101.36
Porto Rico				35.3		30.3	9,162.17		9,162.17
South Carolina			16.1	4.0	14.1		58,305.52	12,691.42	70,996.94
South Dakota	37.2		169.2	20.6	90.9	1.5	352,700.61	118,150.75	470,851.36
Tennessee	2.0	35.4	14.2	367.7	15.5	367.7	128,194.96	80,050.00	208,244.96
Utah	151.1	393.5	952.2	1,133.5	261.1	275.0	1,639,192.98	641,728.97	2,280,921.95
Virginia	16.0	82.5	42.0	557.4	103.5	557.4	187,693.02	24,499.49	212,192.51
Washington	111.1	335.8	477.4	919.6	525.7	4,581.8	3,074,859.08	1,073,659.32	4,148,518.40
West Virginia	2.0		2.0	71.0	17.5	184.0	8,260.36	500.00	8,760.36
Wyoming	165.0	162.5	617.9	500.9	665.6	1,520.5	1,808,270.60	253,641.03	2,061,911.63
Total	1,857.0	4,805.2	8,711.7	15,874.6	8,642.5	33,711.9	133,593,101.00	10,396,663.69	43,989,764.69

<sup>1</sup> Includes \$995,151.30 "Other Federal funds."

The apportionment between States of the appropriations available for the fiscal year is shown in Table 17. A summary of all apportionments is also shown. These amounts include not

only the amount actually appropriated but also, for the fiscal year 1924, the amount which the Secretary is authorized to obligate by contract or otherwise.



TABLE 17.—*Distribution among the States of the total appropriations and of the apportionment for the fiscal year 1925*

State	10 per cent fund		Section 8 fund		Federal forest road construction fund		Forest highway fund		Forest development fund		Grand total
	Fiscal year 1925	Total	Fiscal year 1925	Total	Fiscal year 1925	Total	Fiscal year 1925	Total	Fiscal year 1925	Total	
Alabama.....	\$70.95	\$420.43		\$11,477.03		\$755.34		\$9,024	\$3,104	\$12,007	\$33,692.80
Alaska.....	12,205.87	92,475.95		422,767.57		206,234.38		1,691,825	95,626	1,787,451	2,514,791.80
Arizona.....	37,685.73	442,052.73	54,209	539,220.62		463,034.32		1,032,455	138,346	1,170,801	3,034,776.67
Arkansas.....	6,572.07	60,532.45	9,732	163,260.43		132,097.03		121,220	37,798	159,018	623,278.91
California.....	124,254.22	731,889.42	126,822	1,302,439.58		1,139,965.01		2,527,632	347,724	2,875,356	7,101,196.01
Colorado.....	35,794.51	426,843.29	67,537	680,261.18		789,083.85		1,243,993	171,548	1,415,541	3,819,637.32
Florida.....	2,374.77	20,504.71	13,980	105,102.01		122,167.49		41,907	4,490	46,397	207,391.21
Georgia.....	1,030.19	4,403.86	35,597	40,547.40		117,322.31		23,346	10,578	33,924	227,122.57
Idaho.....	52,650.50	519,555.21	114,764	1,068,433.44		1,376,672.70		1,891,838	589,402	2,481,240	7,123,959.35
Kansas.....		1,867.27									1,867.27
Maine.....	288.59	1,252.51		169.42		3,738.77		4,735	2,426	7,161	19,501.90
Michigan.....	11.94	802.71		15.00		3,000.00		7,297	3,376	10,673	24,086.71
Minnesota.....	2,493.33	17,050.77		8,100.47		110,335.78		108,378	21,918	130,296	353,522.02
Montana.....	33,114.70	421,505.60		669,453.15		743,455.36		1,512,069	405,084	1,917,153	4,731,266.11
Nebraska.....	1,117.75	12,929.94		26.98				13,067	5,466	18,533	54,114.92
Nevada.....	10,186.74	110,568.87		174,873.28		82,858.62		359,698	13,702	373,400	810,779.77
New Hampshire.....	3,637.89	16,025.08		191.18		10,829.38		60,293	12,772	73,065	137,158.64
New Mexico.....	19,053.37	259,024.37		385,677.12		518,506.46		788,471	94,816	883,287	2,360,962.95
North Carolina.....	3,711.69	20,006.16		70,934.97		202,419.86		48,714	24,798	73,512	438,654.99
North Dakota.....		45.75		15.00							60.75
Oklahoma.....	758.79	6,054.86		53.48		2,771.72		2,022	4,734	6,756	36,802.86
Oregon.....	70,777.51	513,673.51		1,244,771.48		1,044,191.57		2,063,597	440,922	2,504,519	6,466,632.56
Pennsylvania.....	100.00	100.00		4.03		17.97		3,031	9,208	12,239	21,569.00
Porto Rico.....		3.70		15.00		3,345.09		2,494	2,734	5,228	16,669.79
South Carolina.....	162.57	537.51		189.52		48,293.91		2,744	4,712	7,456	69,892.94
South Dakota.....	9,773.97	87,623.57		75,777.63		80,055.30		132,631	11,200	143,831	462,626.50
Tennessee.....	1,388.38	9,915.00		79,812.70		30,118.59		35,491	12,442	47,933	203,461.29
Utah.....	23,276.23	206,240.82		398,975.39		472,102.18		641,731	62,872	704,603	2,069,051.39
Vermont.....	3,793.36	18,247.07		63,028.35		74,830.91		47,591	24,660	72,251	299,629.33
Washington.....	35,617.38	282,263.69		850,602.18		709,307.47		1,225,880	381,492	1,607,372	4,433,926.34
West Virginia.....	369.39	2,055.97		132.67		2,243.77		13,258	7,782	21,040	47,856.41
Wyoming.....	28,467.07	244,657.82		417,281.95		562,115.91		829,899	124,268	954,167	2,569,001.68
Special fund.....				100,000							100,000.00
Undistributed.....				126,389.79		47,214.05					173,603.84
Grand total.....	520,739.92	4,591,149.60	1,000,000	9,000,000.00		9,000,000.00		16,500,000	3,000,000	11,500,000	50,591,149.60

TABLE 18.—Condition of road appropriations on July 1, 1924

Fund	Total appropriations to June 30, 1924	Total expenditures	Unexpended balance
10 per cent.....	\$4, 070, 409. 68	\$3, 562, 746. 85	\$507, 662. 83
Section 8.....	8, 000, 000. 00	6, 555, 055. 32	1, 444, 944. 68
Federal forest road construction.....	9, 000, 000. 00	8, 783, 600. 25	216, 399. 75
Forest highway.....	13, 000, 000. 00	7, 468, 006. 41	5, 531, 993. 59
Forest development.....	8, 500, 000. 00	6, 228, 540. 87	2, 271, 459. 13
Total.....	42, 570, 409. 68	32, 597, 949. 70	9, 972, 459. 98

The above tabulation shows the condition of the five forest-road appropriations on June 30, 1924.

The unexpended balances on June 30, 1924, were considerably larger than was expected. This was largely due to the fact that contract work did not progress as rapidly as anticipated and withdrawals from the Treasury were reduced accordingly. The rapidity with which such work is done is strongly influenced by weather and labor conditions.

Marked progress was made in the construction and improvement of roads and trails necessary for the administration or protection of the national forests or for the utilization of forest resources. As yet the work is only well under way, but even now the benefits are very apparent. These benefits will increase as the forest development road system approaches completion. The mileage on this system will be considerably greater than of the forest highways, which are built primarily for public traffic, but its cost will be much less on account of the much lower standards required.

TABLE 19.—Designation of forest roads as forest highways, June 30, 1924

States	Mileage			
	Total	Class 1	Class 2	Class 3
Alabama.....	34. 0	-----	-----	34. 0
Colorado.....	1, 654. 7	-----	1, 179. 1	475. 6
Florida.....	118. 0	3. 0	13. 0	102. 0
Georgia.....	81. 0	-----	-----	81. 0
Idaho.....	1, 101. 0	-----	754. 0	347. 0
Michigan.....	20. 0	-----	-----	20. 0
Minnesota.....	166. 5	-----	38. 5	128. 0
Montana.....	1, 172. 0	145. 0	700. 0	327. 0
Nebraska.....	25. 0	-----	-----	25. 0
Oklahoma.....	33. 0	-----	-----	33. 0
South Carolina.....	17. 0	-----	6. 0	11. 0
South Dakota.....	214. 0	2. 0	153. 0	59. 0
Utah.....	646. 0	-----	420. 0	226. 0
Total.....	5, 282. 2	150. 0	3, 263. 6	1, 868. 6

Much time and effort have been given to the designation of the forest highway system, and while a great deal has been accomplished much remains to be done. In fact, the work will never be absolutely complete; it will always be necessary to make minor eliminations, additions, and changes. At the end of the year the record for those States where no further action or designation is immediately contemplated is shown in Table 19.

Partially complete systems have been outlined for the States of Arizona, Arkansas, Maine, Nevada, New Hampshire, Tennessee, Virginia, Washington, West Virginia, and Wyoming. In the remaining States the only roads designated as forest highways were the projects approved by the Secretary of Agriculture for early survey and construction. Except as required for immediate survey, construction, or maintenance operations, the designation of the forest development roads has been temporarily suspended awaiting further study and final designation of the forest highway system. This work is to be actively pushed after the termination of the field season.

#### MAPS AND SURVEYS

Forty-five maps of national forests, on various scales, were compiled and printed. Though made primarily for administrative use these maps are of considerable value to the public, with a resulting demand for them often greater than can be met. Authority to sell the maps and use the receipts to meet the cost of printing larger supplies would be advantageous.

The large percentage of national forest areas not yet adequately mapped creates an urgent administrative need for more rapid progress in this field by the primary map-making agencies of the Federal Government. The Forest Service itself makes special or



detached maps as occasion necessitates. The present requirements of the protective work against fires and the increased activity in timber sales have resulted in a considerable volume of such work. It is done in conformance with the specifications of the Federal Board of Surveys and Maps.

## RESEARCH

### TIMBER-GROWING INVESTIGATIONS

Forest Service investigations to secure the scientific knowledge essential for intelligent forest management are conducted mainly and increasingly through the forest experiment stations. These are to be conceived of not as local establishments where an institution of research conducts experimental work within the narrow confines of certain buildings and adjoining grounds, but as headquarters and nuclei for organizing the study of great regional problems and needs, through whatever agencies may be found serviceable, and for disseminating as well as gathering knowledge. The ultimate program is to have one such experiment station for each of the 10 major forest regions of the United States.

Around each station is developed a group of model or demonstration forests, usually provided through cooperative arrangements with private landowners or by setting aside experimental areas on public forests where they are available. These will cover all important forest types in the region as well as its significant forest industries, like the production of naval stores in the southern pineries. On these experimental or demonstration tracts, various methods of cutting and reproducing the local species of timber are tested; exact measurements of growth and yield are obtained; and all practicable methods of tree planting or artificial seeding are tried out. Such tests and observations must necessarily be carried on without interruption, for many years. Aside from making their results available currently to the foresters and landowners of the region, accurate data are accumulated on which comprehensive publications can be prepared from time to time dealing with the silviculture of forest types or important forest species.

Those now established and functioning with a fair approach to adequacy for their tasks are the southern station, with headquarters at New Orleans; the northern Rocky Mountain

station, with headquarters at Missoula, Mont.; the Appalachian station, with headquarters at Asheville, N. C.; the New England and Lake States stations, with headquarters respectively at Amherst, Mass., and St. Paul, Minn.; and the Pacific Northwest station, with headquarters at Portland, Oreg. The Northeastern and the Lake States stations were opened early in July, 1923. On July 1, 1924, funds became available for largely expanding the work of the southern station and for establishing the new Pacific Northwest station.

Already it has become evident that these stations are certain to be of prime importance in hastening the general practice of forestry within their several regions. Their influence is partly due to the fact that they become centers about which gather the interest and activities favorable to progress in forestry. Thus they perform a function of leadership. They are valuable sources of information and advice both to public agencies and to private owners interested in forestry, as well as instrumentalities for correlating and directing investigative undertakings along the most fruitful lines. They will undoubtedly be of the utmost value in helping the States to formulate policies of forestry, as well as powerful influences making for its private practice.

A properly equipped forest experiment station for California is the next urgent need. It is also important to enlarge to a scale adequate for attacking their broad regional problems the limited stations now existing in the Southwest and in Colorado. When practicable, another station dealing with the central hardwood and Allegheny region should be added to the chain. The United States is entering a period of rapid progress in timber culture as a common form of land use; and the development of a groundwork of accurate technical information is one of the most necessary functions of Federal leadership.

### THE PAPER PROBLEM

With the help of the American Paper and Pulp Association the Forest Service in the early part of the year made a detailed study of our paper problem, the results of which were published as Department Bulletin No. 1241, "How the United States can meet its present and future pulp-wood requirements."

The United States in 1922 used 8,000,000 tons of paper, more than



half the world's total consumption. Since 1909 our consumption of paper has nearly doubled; since 1899 it has nearly quadrupled. From 1899 to 1922 the per capita consumption increased from 57 pounds to 147.

This great demand for paper has been met partly through imports. First we imported pulp-wood, then pulp, and finally paper. By 1922 only 49 per cent of the wood entering into the paper consumed in the United States came from our own forests. Of the pulp used in making this paper, 60 per cent was a home product, while of the paper itself 88 per cent was manufactured in the United States. In other words, of the 8,000,000 tons of paper used in 1922 we imported 1,000,000 tons in the finished state. To make the total amount of paper consumed, 9,148,000 cords of wood were required, of which less than 5,000,000 cords came from our own forests. The rest was imported, either as paper, pulp, or pulp wood.

This importation, which continues to grow, measures our dependence on foreign sources for paper, pulp, and pulp wood, sources that may at any time be curtailed or shut off by foreign competition, embargoes, or war. The need of independence of such foreign sources is all the greater because by 1950 or thereabouts, according to the present trend of paper consumption, it will take 15,000,000 or 16,000,000 cords of wood to supply the American people.

The problem is complicated by the fact that our pulp and paper industry, in spite of its great size, is concentrated chiefly in the New England, Middle Atlantic, and Lake States, where the most available stands of spruce, fir, and hemlock have occurred. This concentration has led to a very heavy drain on the forests of these regions. Few mills are located in Alaska, the Pacific coast, and the Southern States, which have much larger supplies of pulp timber.

Under intensive management more than enough pulp wood to meet the prospective demand of 15,000,000 or 16,000,000 cords can be grown on our own forest land. If our pulp and paper industry is to be a permanent one, forest destruction must give way to timber culture. To get an adequate supply of pulp wood by growing it, however, will take decades. Meanwhile the pulp wood shortage demands immediate measures of alleviation. The present problem is to find enough spruce, fir, and hemlock to keep the

industry going. Alaska, the Pacific Coast States, and the northern Rocky Mountains have at present more than enough of these species to replace our imports. If these particular woods are used in the future, however, in their present ratio to other species, they will make up 12,000,000 of the 15,000,000 or 16,000,000 cords of pulp wood we shall ultimately consume each year. The spruce, fir, and hemlock forests of the East and West, even if put under intensive management, can only barely produce this amount of pulp wood as a continuous crop.

These facts indicate that the industry should join with public agencies to insure a sufficient supply of pulp wood. There must be adequate protection against fire in our pulp-wood forests. There must be more research and application of research in pulp and paper making. The use of young timber for pulp wood must be supplemented and in time largely replaced by material now wasted—crowded trees that ought to be thinned out of the forest but are now left to die, defective logs, limb wood, and sawmill and factory waste. Wastes in the pulp and paper mills should be cut down. Species of timber not now used for paper will have to supplement those on which the present demand is concentrated. The drain on our Northeastern and Lake States forests should be relaxed by building up the paper industry in other forest regions. Above all, the industry will, if it is to survive, be obliged to take up intensively the growing of its own timber supply.

The activities of the Forest Service in timber growing, in pulp and paper research, and in economic studies of pulp wood, pulp, and paper give the Department of Agriculture an important relationship with this industry. Recognizing the common interests, the Secretary of Agriculture has organized an advisory committee of the pulp and paper industry. The purpose of this committee is to counsel with the department on joint action in dealing with the problems of timber growing and pulp and paper making. The first meeting of the committee, held in Washington last winter, led to the formation of regional advisory subcommittees to work in cooperation with the Northeastern, the Lake States, the Appalachian, the Southern, and the Pacific Northwest forest experiment stations. It is hoped that these committees will bring the industry and the department close together on a

comprehensive program of forestry and better forest utilization.

## FOREST PRODUCTS INVESTIGATIONS

### WOOD WASTE AS A MAJOR FOREST PROBLEM

That wood waste is a forest problem in the same class with timber growing and fire protection is well recognized. Not only are our forests being cut several times as fast as they are growing, but something like two-thirds of the cut is lost in the processes of manufacture and through inefficient use, fire, and decay. The total waste in logging and manufacturing is estimated at not less than 9,000,000,000 cubic feet per year, or more than 35 per cent of the annual drain on our forests. Not all this waste could be avoided; but more care in manufacturing and using timber, based on knowledge already available, would permit us to save a substantial part of the loss. Ultimately, with increased knowledge and opportunities for closer utilization, we should save at least half of it.

Obviously these possible savings have a most important bearing on our forest program. Under the most intensive forest management it would take nearly our whole forest area of 470,000,000 acres to grow enough timber to balance the present yearly cut. But no one imagines we can get our whole forest area under intensive management short of two or more decades. If, meanwhile, we materially cut down the waste, we can make our timber supplies last longer or in effect reduce the rate at which we are draining our forests.

The problem is to find out where these wastes occur and how they can be avoided. We know roughly the magnitude and the sources of the chief wastes, though a vast amount of detailed investigation will be needed to ferret them all out. Waste occurs in inefficient methods of logging and milling timber or because of lack of knowledge of profitable uses for log and lumber by-products and for the so-called inferior tree species; it occurs in manufacturing, in seasoning the lumber, in building, and in the use of expensive grades and species where inferior ones would do; it occurs in preventable decay, so that a large share of all the building lumber cut is required for replacement; it occurs through damage to timber by poor methods of turpentineing, and

through the waste of poor timber that might be used for distillation.

Finding out and combating these wastes is the chief function of forest products research. The Forest Products laboratory has brought to light an immense amount of knowledge on wood—how to save it and how to use it. So serious has the timber shortage become, however, that the waste problem ought to be attacked more vigorously and on a larger scale than ever before. Joint action by the Government and the forest industries must be brought to bear.

As the Government's contribution to this problem, the Forest Service is seeking to materially expand its attack on timber waste in various directions. One important phase of waste—that occurring in the woods—has received too little attention. In large part woods and mill waste has never been studied intensively or scientifically, yet it is known that only about one-third of the volume of the forest is converted into lumber. General studies are planned, in the woods and at the sawmills, to determine what improvements can be made to reduce wastes. Much intensive study will be needed, not only of methods but of equipment and machinery.

The wastes in remanufacturing lumber into commodities, though not so large as the woods waste, are still very great. In one way they are more serious because they include material into which the costs of logging, primary manufacture, and transportation have already entered. An important line of investigation that should be enlarged is the study of the use of small pieces of wood (so-called dimension stock) in making furniture, vehicles, etc., in place of cutting up large boards with great loss. Another piece of new work planned is a thorough study of the use of construction timber. Timber is often wasted by poor designing. Some building codes, for example, require structural timbers three times as strong as other codes.

About one-fourth of all construction lumber is used to replace wood decayed in service. The total loss from decay is doubly heavy because it includes the cost of logging, manufacturing, seasoning, transporting, and placement. One development badly needed in wood preservation is a cheap preservative suitable for use in house construction and on farms. The use of preservatives in porch and foundation timbers and on fence posts would



alone save much timber. The objectionable odor and color of creosote and its inability to take paint must be overcome.

Another field needing greater study is that of shipping containers. The laboratory has demonstrated that a great saving of wood can be secured by the better design of crates and boxes, and immensely greater savings, of course, of commodities injured or destroyed in shipping. One phase of the study, to be planned in cooperation with railroads, express companies, and post offices, is to determine the character and magnitude of shipping losses and the conditions of transit, as the basis of a much broader attack on the container problem.

But it is fruitless to amass facts about wood unless the manufacturers and users of forest products apply them. It is to the self-interest of the manufacturer and user to reduce preventable wastes, although traditions, customs, trade prejudices, carelessness, and set ways of doing things, stand in the way. The program of research must be supplemented by a vigorous effort on the part of forest industries to get research results applied. One of the most promising methods in this field is through the employment of demonstration experts by the industries themselves. Another method is through joint industrial experiments and commercial tests of new methods. Plans are now under way to greatly stimulate industrial activities of this sort.

This program of joint action by the Forest Service and the forest industries means that the laboratory will confine its function chiefly to research, while the industries, it is hoped, will assume a far greater responsibility than they have assumed before in applying research findings to their manufacturing processes. To achieve this result would be to give our forests a new lease of life.

#### WORK OF THE FOREST PRODUCTS LABORATORY

Study of the dimension-stock requirements of various industries has been directed especially at reducing the numbers of different sizes needed for furniture, vehicles, etc., so as to simplify the problem of making and buying dimension stock. The use of dimension stock is growing steadily.

At a conference called in Washington last December by the Secretary of Commerce basic grading rules for

softwood yard lumber worked out by the Forest Products laboratory were ratified by representatives of the manufacturers, distributors, and consumers. These rules are now being put into effect and will greatly simplify lumber grades. A study of the grading of hardwood factory lumber has now been undertaken at the request of the lumber industry as the next step in lumber standardization.

The report on methods of conducting strength tests on small clear specimens and structural timbers prepared at the laboratory was adopted by the sectional committee of the American Engineering Standards Committee. This report is a big step toward uniform methods, to make tests from different sources comparable. The methods of the Forest Products laboratory are already in use in the Canadian forest products laboratory and the British laboratory at Dehra Dun, India.

In cooperation with the Navy, investigations of the design of wood airplane parts were continued. A final report was made on the effect of kiln-drying on the strength of airplane woods, one of the largest projects undertaken at the laboratory, involving about 150,000 strength tests. It was conclusively proved for the 28 species studied that equally strong wood can be obtained by kiln-drying and by air-seasoning, a conclusion of great importance when the saving of time may be vital. The practical application of research findings resulted in substantial progress in reducing seasoning losses. Various southern and western lumber companies installed or experimented with the lately developed Forest Service internal-fan kiln. Douglas fir, western pine, and southern shortleaf and longleaf pine were the species used.

Preliminary kiln drying as a means of overcoming deterioration (principally from sap stain) in gum lumber was strikingly tested in cooperation with a southern mill, which expects as a result to eliminate a large portion of its losses in seasoning, estimated last year at \$35,000. In Wisconsin one company by using internal-fan kilns has already largely eliminated its seasoning losses of hardwoods used for furniture. In air seasoning experiments carried out in the South, the Pacific Coast States, and the northern Rockies it was shown that large losses from checking and staining can be materially reduced by better methods of piling and handling.



Progress has been made in important phases of the preservative treatment of timber. Lodgepole pine, extensively used for railway ties, is difficult to treat, the methods commonly employed giving an irregular and ineffective penetration of the preservatives. The laboratory last year devised methods that doubled penetration without decreasing the output and with a marked saving in cost.

Research is playing a significant part in the progress of the paper industry toward greater efficiency. For several years the laboratory has been studying the effects of decay of pulpwood and pulp and methods of handling and storing which will reduce decay. The laboratory is about to publish an important bulletin on this subject which should be of great value to the industry.

The utilization of waste bark, the reduction of wastage of wood fibre, and the use of new species for paper are among the important projects the laboratory is working on. A new species, *ailanthus*, gave high yields of pulp in several tests, with an easy bleaching pulp. The growth of the tree is quite rapid. Tests on extracted chestnut wood indicate that a pulp can be made from it suitable for board and wrapping paper.

#### RANGE INVESTIGATIONS

The 11 western range States include about 110,000,000 acres of ranges, 175,000,000 acres of unappropriated and unreserved public domain, and 350,000,000 acres or more of State and private range lands, Indian reservations, etc. The lands not in the forests provide the principal spring, fall, and winter range. There is urgent need for more exact information on their proper use. Scientific management and utilization of range areas are essential to a stable and profitable range livestock business. The industry greatly needs more economical production. Experiments have shown that more efficient use of range forage offers great possibilities in this direction.

Only the most urgent problems confronting the grazing administration of the national forests can be handled by the small investigative organization available. These include such questions as the proper stocking of the ranges, seasonal and rotation use that will increase the growth of the more valuable plants, the effective handling and distribution of livestock, and the eradication of poisonous plants.

During the year the investigations of grazing management on browse ranges in the Southwest and grazing management of logged-over lands in the Northwest were expanded. The former is of particular moment because of the value of the semidesert browse areas as breeding ranges and, at the same time, their importance in watershed protection around expensive irrigation works. The latter study aims to formulate a grazing practice which will insure for the vast areas of logged-over lands adequate reforestation, reduction of fire hazard, and profitable returns for grazing.

Studies of a number of important range problems in Montana were undertaken by the Forest Service in cooperation with State agricultural college experiment stations and other bureaus of the Department of Agriculture.

The 10-year study of the effect of grazing on the erosion of alpine lands at the Great Basin Experiment Station in Utah has demonstrated that revegetation of the range from a seriously depleted condition has reduced flood run-off and erosion by approximately 66 per cent. This emphasizes the necessity for preventing any grazing practice which causes the destruction of cover or retards the establishment of a permanent and complete stand of vegetation. The investigations at the Santa Rita and Jornada Range Reserves in Arizona and New Mexico have further emphasized the value of the systems of management previously developed for maintaining efficient production from high grade breeding herds of cattle in that region of uncertain rainfall. While many southwestern ranges were seriously depleted last year as a result of drought and hundreds of thousands of cattle had to be moved to save them from starvation, losses on the reserves were little more than normal and the calf crop and development of steers were satisfactory considering the dry conditions.

#### GRAZING RECONNAISSANCE

Approximately one-fifth of the range lands of the national forests have now been covered by grazing reconnaissance and definite plans developed for their administration and management. The importance of the national forest ranges to the livestock industry demands more rapid progress in determining accurately just what our grazing resources are and more adequately how they can be managed to contribute

the most, in conjunction with the use of private lands, to the development of the West.

#### EXTENDING TECHNICAL GRAZING KNOWLEDGE

Trained grazing specialists are constantly being developed by the Forest Service for important administrative tasks. The education of the entire administrative force in range management by study courses, instructional inspection, group demonstrations, and in other ways is given attention, while the results of research are also disseminated among grazing permittees. Active cooperation has been established by the Forest Service with the Extension Service of the Department of Agriculture and of the western State agricultural colleges in the handling of their seven-year extension program of range management. The demands on the small corps of grazing specialists in the Forest Service are very great.

#### INFORMATIONAL AND EDUCATIONAL ACTIVITIES

Reference has already been made in various parts of this report, in connection with other subjects, to the need for informational and educational work, to the results of such work, and in part to the methods used. The primary purpose of work of this character in connection with national forest administration is to obtain the fullest possible cooperation of the public in lessening the fire danger and fire losses on the public properties. Both as a means to this end and as an object independently, the Forest Service has always steadily sought to acquaint the public with the practical purposes of administration of the forests, and of the methods applied in order to realize these purposes.

The best use of the forests and the most desirable relationships with the forest users can not exist unless the latter understand the objects of administration and stand ready to cooperate for the attainment of these objects. Nor is mere approval of the objects sought sufficient; there must also be an understanding of the methods employed, and acceptance of them as practicable and beneficial. Regulated use, no matter how well conceived it may be, would work badly in practice if it relied merely on the power of the Government to enforce it instead of endeavoring to secure public acceptance and good will.

The national forest enterprise, however, is of concern not only to the actual users of the forests but to all local residents and to the whole public. The object of the enterprise is general benefit to the people of the country. In the long run the judgment of public opinion as to the actual value of the forests must determine whether the enterprise shall be maintained. In administering the forests, therefore, continuous and painstaking effort is made to familiarize both users and nonusers, as generally as possible, with the purposes sought and the methods employed.

The main reliance for this is utilization of the opportunities afforded by the personal contacts of forest officers with users, other citizens, local organizations, and the communities in and near the forests. Public interest in the local work of the forest officers and in the general purpose of administration is such that forest officers are constantly called upon for public talks, press information, and information for schools. To facilitate and systematize what they do along these and similar lines such activities are organized and supervised in the same way as other lines of service work. The activities involved and the unit of organization which directs them are designated "public relations."

Substantial progress was made through public relations activities in building up greater interest on the part of the public in the protection of the national forests against fire and in obtaining a larger measure of cooperation for the control of fire. One of the best illustrations of what can be accomplished in this field is the widespread and admirable response of the people of California to the emergency created by the forest fire hazard in that State during the past summer. This included the organization of an emergency committee of citizens, with members from nearly every county, volunteer help to the State and Federal agencies from many local organizations, industries and other groups, and effective publicity through the four corners of the State inculcating special precautions to reduce the fire hazard. A number of public spirited business firms contributed largely to the fire-prevention campaign through signboard advertising and other means.

The task of the Branch of Public Relations in the Forest Service, however, is not limited to securing increased efficiency of administration and protection of the national forests

through the informational and educational activities of forest officers. It includes furtherance of the practice of forestry throughout the country, efforts to bring about better utilization of forest products, and making better known the public aspects of forestry.

In this work the Branch of Public Relations cooperates with the other branches of the service by which certain phases of the work are conducted. The latter include cooperation with States in fire protection, extension of the actual practice of forestry through

technical information and advice to private forest owners, and the diffusion of information relating to the use of forest products and the growing of timber crops. The results of the work done during the year by the Forest Service for the promotion of better protection and use of the forests of the United States generally, and for the more efficient use of forest products, were discussed in the opening section of the report and in the section dealing with research.







DEC 10 1924

EXPERIMENT STATION

## REPORT OF GRAIN FUTURES ADMINISTRATION

UNITED STATES DEPARTMENT OF AGRICULTURE,  
GRAIN FUTURES ADMINISTRATION,  
Washington, D. C., September 9, 1924.

SIR: There is transmitted herewith the annual report of the Grain Futures Administration for the year ended June 30, 1924. I take pleasure in acknowledging indebtedness to the entire organization of the Grain Futures Administration for exceptional willingness and faithfulness in meeting the demands placed upon them in gathering and compiling information and otherwise carrying out the purposes of the grain futures act, and particularly to Messrs. J. W. T. Duvel and Carl E. Parry for the planning of this report, and the assembling and preparation of the material which it contains.

Very respectfully,

CHESTER MORRILL,  
*Assistant to the Secretary.*

Hon. HENRY C. WALLACE,  
*Secretary of Agriculture.*

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### INTRODUCTION

This is not the first annual report of the Grain Futures Administration, because brief reports were rendered in 1922 and 1923, but it is the first of comprehensive character. This is because the legislation of which the Grain Futures Administration is the outgrowth was suspended by litigation until shortly before the beginning of the year that has now ended.

This legislation was the outgrowth of more than 35 years of congressional discussion and investigation. A bill was introduced in Congress in 1884 relating to trading in futures, and by 1921 there had been at least 126 such bills introduced, on many of which hearings were held in committees and debates took place in Congress. In 1921 Congress enacted legislation (the future trading act of 1921) which attempted, among other things, to bring



the grain-futures exchanges of the United States under Federal supervision and regulation by the exercise of the taxing power. This legislation went into but partial effect, because most of its provisions were held unconstitutional in May, 1922, by the United States Supreme Court. The activity of the Grain Futures Administration was meanwhile confined almost entirely to work done under section 9 of the future trading act, which provided for the making of investigations by the Secretary of Agriculture regarding the operations of boards of trade. In September, 1922, Congress enacted, under the interstate commerce power, the grain futures act of 1922, having the same general purpose as the future trading act of 1921. The grain futures act was held constitutional on April 16, 1923. During the whole of the year ended June 30, 1924, therefore, the grain-futures markets of the United States have been under Federal supervision and regulation, and the work of the Grain Futures Administration has accordingly been more extensive and significant than during preceding years. This report therefore gives an analysis of the grain-futures act, a systematic account of the principal steps which have been taken toward carrying the act into effect, and a presentation of some of the information which has been gathered together in pursuance of a chief purpose of the act. This includes information accumulated in previous years while the litigation was pending.

The principle which underlies the grain-futures act is set forth in section 3 of the act, which declares transactions in grain futures to be "affected with a national public interest." The significance of this proposition, it is hoped, will become increasingly evident to all concerned as general understanding of the act progresses, based on further experience of its workings. To promote such understanding is a chief purpose of this annual report.

### GENERAL OBJECTS OF THE GRAIN FUTURES ACT

The principal purposes of the grain-futures act, as indicated by analysis of the act itself, are presented in general terms in the following outline. They are so stated as to indicate their relations to one another as well as the relation which all of them bear to the conception that trading in grain futures is affected with a public interest.

(1) To obtain for the use of Congress and the enlightenment of the public

authentic and comprehensive information regarding trading in grain futures. As some writer expressed it, Congress intended "to remove the mystery" from grain futures. To accomplish this object, the law contains provisions requiring the making of adequate original records of cash and future transactions on boards of trade, the keeping of such records for a sufficient length of time, and the rendering of reports based thereon. Such records must show all the details and terms of all such transactions. They must be kept for three years or longer, if required by the Secretary of Agriculture, and must be open to inspection by properly authorized representatives of the Departments of Agriculture and Justice. Proper safeguards are provided against the unauthorized publication of information which would separately disclose the business transactions of any person or trade secrets and names of customers.

(2) To prevent the dissemination by boards of trade or their members of false or misleading reports concerning crop or market information or conditions that affect the price of grain.

(3) To prevent the misuse of facilities of grain futures exchanges in ways which result or tend to result in "sudden and unreasonable fluctuations in prices" or in the cornering of grain.

(4) To make the contract markets open markets for producers by preventing the arbitrary exclusion of properly formed and conducted co-operative associations of producers engaged in the cash grain business which act for their members on a patronage dividend basis.

(5) To limit trading in grain futures to boards of trade located at terminal cash grain markets where there are available official inspection service and satisfactory grain marketing conditions.

### ADMINISTRATION OF THE ACT

In order to carry out the purposes indicated in the preceding outline, the Secretary of Agriculture has (1) established the Grain Futures Administration, with field offices at important central markets; (2) secured necessary changes in the rules and regulations of grain futures exchanges to conform to the requirements of the grain futures act; (3) extended the official designation of "contract market" to 10 such exchanges; (4) promulgated general rules and regulations, including requirements as to rendition of daily

reports of transactions, the keeping and inspection of adequate records of transactions, and the observance of the conditions required for carrying out the law; (5) obtained, compiled, and published information regarding trading in grain futures; and (6) taken measures to prevent the dissemination of false and misleading market information and the misuse of market facilities.

The administration of the act has been conducted directly from the office of the Secretary of Agriculture, under the direction of the assistant to the Secretary serving as officer in charge of the Grain Futures Administration, located in Washington, and grain exchange supervisors located at Chicago and Minneapolis.<sup>1</sup> These supervisors have at their disposal all the sources of information to which this report makes reference, both in their original form and in more refined and studied forms. Both of these supervisors have had extensive experience in the grain business and have a wide acquaintance in the grain trade. They are continuously present in the markets where they have their headquarters, in daily contact with traders in futures and in cash grain on the floor of these markets, and in frequent contact with the officials of all the exchanges, whose cooperation has been regularly sought and very generally extended. To these supervisors informal inquiries are frequently addressed by parties both inside and outside these cities, all of which inquiries are given respectful attention and handled with due regard to the public interest and to the requirements of the grain futures act and the Government regulations which forbid, as indicated elsewhere in this report, the making known in any manner (except as regards parties found guilty by prescribed procedure of violating the provisions of the act) of "information which would separately disclose the business transactions of any person and trade secrets or names of customers." The regular policy of these supervisors is to use the information in their possession as a basis for bringing to the attention of the officials of the exchanges the primary responsibility imposed by the act upon the latter for the proper conduct of exchange affairs. Wherever provision by general rule for the modification of current practices in the grain futures business seems to be possible and desirable, the

matter of having such provision made voluntarily by the exchanges themselves is uniformly emphasized.

The 10 exchanges that have been officially designated as "contract markets" are the Board of Trade of the City of Chicago (usually referred to in this report as the Chicago Board of Trade or simply as Chicago), the Chicago Open Board of Trade, the Minneapolis Chamber of Commerce, the Duluth Board of Trade, the Kansas City Board of Trade, the St. Louis Merchants' Exchange, the Milwaukee Chamber of Commerce, the Baltimore Chamber of Commerce, the Los Angeles Grain Exchange, and the Grain Trade Association of the San Francisco Chamber of Commerce. The first 7 of these markets normally handle more than 99 per cent of the trading in grain futures which takes place in the United States, and during the three years 1921 to 1923 the Chicago Board of Trade handled 87.65 per cent of the total futures trading on these 7 markets.

The remainder of this report is devoted to a more detailed account of the steps which have been taken, together with some description of the conditions which have been met. It lays special emphasis upon the information which is being collected for the purpose of enlightening the public, laying an adequate basis for regulation, and for other purposes. The markets to which this information relates include as far as possible all the markets which have been officially designated as "contract markets." The account goes into detail for three principal reasons. The first reason is that during the initial year the steps taken by the Grain Futures Administration are of pioneering and foundational character, each of which, therefore, deserves to be made a matter of public record, together with the conditions under which it was taken and the reasons for taking it. The second reason is that the efficiency of the Grain Futures Administration and of the grain futures markets as well depends in unusual degree upon the extent to which matters generally considered mysterious and technical can be made clear to the general public. The third reason is that experience has shown that facts and figures submitted to inquiring correspondents or published from time to time by the Grain Futures Administration as part of its regular work, or by other agencies, require for their proper interpretation more information concerning the conditions under which they have been obtained than can be embodied briefly in every statement as issued.

<sup>1</sup> Through cooperation with the State of California the Grain Futures Administration is represented as to the Los Angeles and San Francisco markets by the chief grain and warehouse inspector, California Department of Agriculture.



The topics treated in the rest of this report are arranged in the order that has been found most convenient for exposition, with the general purpose of treating (1), the requirements of the grain futures act itself; (2), the administrative regulations which have been promulgated under the act; and (3), certain information which will illustrate the nature of the information that has been obtained and that has also been published, either in sources to which reference is made or in this report itself.

### DESIGNATION OF CONTRACT MARKETS

A notable feature of the grain futures act is the obligation which it imposes upon boards of trade, in their organized capacity, to bring the conduct of their individual members into line with the requirements of the act. The official "designation" of "contract market" is essentially a license, a license not extended directly to individuals, but rather to boards of trade in their organized capacity. In order to obtain such license the governing boards of exchanges are required to adopt certain general rules of government designed to carry the act into effect; and in order to retain such license such governing boards are obliged to assume and to exercise a continuing responsibility for the observance by individual members of all exchanges of these rules of government.

The requirements with which the 10 designated markets have complied in order to obtain official designation as "contract markets" will be set forth presently. Meanwhile, it is to be noted that the action of Congress in affirming trading in grain futures on the boards of trade to be affected with a national public interest and in extending supervision over them, notwithstanding the opposition of the exchanges, has given a sanction and a legal standing to these institutions never before possessed by them. Use has already been made of this point of view in the case of *State of Kansas v. The J. Rosenbaum Grain Co.*, and the *Postal Telegraph & Cable Co.*, in the Supreme Court of Kansas, decided January 12, 1924. This was an action to enjoin the grain company from operating a commission house at Hutchinson, Kans., and the telegraph company from furnishing telegraphic facilities, by reason of State statutes relating to dealing in futures and to "bucket shops." The court held that, Congress having constitutionally assumed authority over trading in grain

futures because of the relation to and effect upon interstate commerce of that business, the business of the grain company lay within the field of Federal regulations covered by the grain futures act and, therefore, was not subject to the State regulations in question. The Rosenbaum Co. was engaged, among other things, in buying and selling grain on commission for various customers for future delivery in accordance with the rules and regulations of the Chicago and Kansas City Boards of Trade. Since this decision was rendered it is understood that grain-futures commission houses have opened offices in States where the laws had theretofore been considered to be adverse.

### RULES AND REGULATIONS OF EXCHANGES

We now come to the enumeration of the rules and regulations, or changes in existing rules and regulations, which have been adopted by the 10 boards of trade which have been officially designated as contract markets. The most comprehensive of these rules runs as follows:

In order to comply with the act of Congress known as the grain futures act, it is hereby provided that all rules of this association shall be construed with reference to, and shall be subject to, and modified by, the provisions of said act.

Certain more specific rules or regulations have also been adopted. Some of these are calculated to emphasize and to effectuate the requirements of the act that records, adequate to serve the public interest, shall be kept, preserved, and used as a basis for the making of regular or special reports to the Government. Thus the Chicago Board of Trade has embodied the following change in its rules to provide for records and reports:

Every member shall make, or file, such report, and keep such record of his transactions as he is required to make, file or keep, by subclause (b) of section 5 of the act, and if he shall fail to do so he shall be suspended by the board of directors from all privileges of membership until he shall comply with the said provisions of said act.

The effect of this rule is to put the authority of the board of trade itself back of those requirements of the act (and of the Government regulations) which are designed to put the Secretary of Agriculture in possession of full information regarding "the operations of boards of trade." In certain markets, e. g., Minneapolis, the following provision has been inserted in the rules and regulations of the exchange: "The secretary shall make and file reports in accordance with provisions of subclause



(b) of section 5 of the act known as "the grain futures act."

Other changes made in the rules and regulations of the exchanges as a condition of designation are as follows:

No member shall disseminate any false, misleading, or inaccurate report concerning crop or market information or conditions that affects or tends to affect the price of commodities, and any member who shall knowingly or carelessly disseminate such reports shall be suspended by the board of directors from all privileges of membership for such period as the gravity of the offense committed may warrant.

No member shall attempt to manipulate prices of commodities, nor corner or attempt to corner any grain, and any member who shall knowingly or intentionally violate the provisions of this section shall be suspended by the board of directors from all privileges of membership for such period as the gravity of the offense committed may warrant.

The board of directors is authorized to take such other steps as may be necessary or advisable to make effective subdivisions (c) and (d) of section 5 of the grain futures act.

Any member who, under subclause (b) of section 6 of said grain futures act, shall be deprived of the privilege of trading in contract markets shall be suspended from all privileges of trading on the exchange of this association for such period as may be specified in the order of the Secretary of Agriculture against such member.

Any member who shall accept, or execute, an order from any person who shall have been deprived of the privilege of trading in contract markets shall be suspended from all privileges of membership in this association for such time as the directors, in their discretion, shall determine.

The effect of the foregoing rules is to record, effectuate, and advertise the general proposition that contract markets, being "affected with a public interest," are to be conducted accordingly. Otherwise stated, these rules of the exchanges publicly acknowledge and accept the responsibility of their governing boards for carrying the act into effect.

The Government regulations incorporating by reference the grain futures act itself, specifically provide that they "shall not prevent the legitimate application or enforcement of any valid by-law, rule, regulation, or requirement of any contract market which is not inconsistent or in conflict with the act and these rules and regulations." The effect of this proviso is to give public assurance that the authority of the exchanges to govern the conduct of their own members, and the responsibility therefor, is not impaired or rendered uncertain by the act.

By way of illustrating recognition by the exchanges of responsibility for the conduct of their members, the following extracts are presented from the rules and regulations of the Chicago Board of Trade, which were in existence long prior to the enactment of the grain futures act:

When any member shall be guilty of improper conduct of a personal character in any of the rooms of the association, or shall violate any of the rules, regulations, or by-laws of the association, or shall be guilty of any dishonorable conduct, for which a

specific penalty has not been provided, he shall be suspended by the board of directors from all the privileges of membership for such period as in their discretion the gravity of the offense committed may warrant. When any member shall be guilty of making or reporting any false or fictitious purchase or sale, or where any member shall be guilty of any act of bad faith, or any attempt at extortion or of any dishonest conduct, he shall be expelled by the board of directors.

It shall be the duty of the board of directors, in case any grave offense or act of dishonesty committed by any member involving the good name or dignity of the association, or any act of dishonesty on the part of a member, shall come to their knowledge, either by complaint or public report, to cause a preliminary or informal investigation to be made by a committee of their number into the truth or falsity of such complaint or report; and if the said committee, after investigation, shall deem any member guilty of such offense, they shall so report to the board of directors, with specific charges; whereupon the member thus implicated shall be notified to appear before the board of directors in manner as provided by section 16 of this rule (see below), and if found guilty the said member shall be suspended or expelled, as hereinbefore provided.

To facilitate the investigation of all cases under this rule, the board of directors, or any committee appointed to make the preliminary investigation, shall have power to call for persons and papers, and every member, firm, or corporation connected with the matter under investigation may be required (unless it shall criminate him or them) to produce his, its, or their books and records covering the matters involved in the charges for examination by the board of directors or its committee of investigation, and any member who or whose firm or corporation shall refuse to comply with this requirement shall be suspended from all the privileges of the association until such requirement shall be complied with.

All charges made to the board of directors against any member of the association for any default, misconduct, or offense, shall be in writing, and in duplicate, and shall state the default, misconduct, or offense charged; and the same shall be signed by one or more members of the association, by a business firm, one or more of whose members shall be a member of the association, or by the chairman of a committee of the association. (Section 16.)

No member shall be censured, suspended, or expelled under this rule without an examination of the charges against him by the board of directors, nor without having an opportunity to be heard in his own defense. No examination shall take place until notice has been served on the accused member or his firm, if the charges apply to the firm, accompanied by a copy of the charges against him or them in writing. Such notice may be served upon the accused personally by the secretary or any of his assistants, or it may be left at or mailed to the accused at his ordinary place of business or residence; in either of which cases the notice shall be considered sufficient, and the examination may proceed whether the accused is present or not.

## RECORDS OF TRANSACTIONS IN GRAIN FUTURES

### THE MAKING OF ADEQUATE RECORDS—REQUIREMENTS OF THE ACT

The act contemplates that records shall be kept of every transaction in grain futures on boards of trade, i. e., of every contract of sale of grain for future delivery, of such character as to show "the details and terms of all such transactions." The details and terms so recorded must show the date of the contract or transaction, the property covered and its price, the parties to such contract or transaction (and their addresses), including the

persons for whom made, any assignments or transfers thereof, with the parties thereto, and the manner in which such transactions are fulfilled, discharged, or terminated. These same requirements apply also to the making of records of cash grain transactions consummated at, on, or in a board of trade.

Transactions in grain futures in the sense in which these are referred to by the grain futures act include primarily such contracts for the purchase or sale of grain for future delivery as are made in the open market on the floor of the exchange during the hours of regular trading, all of which are subject to the rules of the exchange. On the Chicago Board of Trade, for instance, all such contracts are "subject to the rules of the Board of Trade of the City of Chicago and the regulations and requirements of its board of directors." This circumstance has an important bearing on the matter of records, because under the rules of the exchanges the parties to every such contract must be members of the clearing association (or clearing house). Non-clearing members of the exchange may enter into such contracts, but they are "obliged to furnish forthwith the name of a clearing member who will accept and be liable for such contract." Persons who are not members of the exchange must, of course, transmit their orders to some member for execution, and resulting transactions on the floor of the exchange must stand in the name of a clearing member. Speaking strictly, therefore, clearing members are the parties to these transactions on the exchange and they look for settlements to one another, not to the "customers" of one another. Each clearing member then looks when necessary to his own customers, who are the persons for whom transactions are made. The available records of futures transactions naturally reflect this condition of affairs, with consequences which will be made evident in the course of this report.

The significance of the requirement of the grain futures act that records be kept is not revealed by the list of specific items to be recorded which has been given in a preceding paragraph. This is because these items coincide substantially with the items already recorded by members of the exchanges for ordinary private or business reasons. The significance of the requirement lies rather in the legislative declaration that both the keeping of records and the form and substance of these records are matters affected with a

public interest. Thus, if experience should show that the list of items specified by the act does not include all the items needed by the Government in order to obtain an understanding of the workings of the grain-futures markets, and to promote such understanding on the part of the general public, or in order to perform efficiently its regulatory functions, then the list may be enlarged by the addition of fresh items. The obligation upon the members of the exchanges, in short, is to keep records which will be adequate for public purposes as well as for private purposes. Only the test of experience will show whether or not the specific requirements now embodied in the act or in the Government regulations made thereunder will prove to be thus adequate.

#### ADEQUATE RECORDS: GOVERNMENT REGULATIONS

The general rules and regulations, with respect to contract markets promulgated under the act by the Secretary of Agriculture under date of June 22, 1923, will be designated in this report for convenience of reference as the Government regulations, to distinguish them from the rules and regulations made by the exchanges themselves, which will be referred to briefly as the rules or the rules of the exchange.

The Government regulations require each member of the exchange to keep the records required by the act, "in chronological order in such manner as to be readily accessible." The only other specification regarding these records, so far as transactions for future delivery are concerned, is that these records shall be made in such manner as to show whether or not "the persons for whom such transactions are executed" are "engaged in the cash grain business." A chief purpose of this specification is to insure that the basic records of all transactions in grain futures will contain information which can be utilized for distinguishing transactions originating with persons engaged in the cash grain business (and therefore presumably representing in considerable part "hedging") from transactions originating with persons not so engaged (and therefore presumably representing for the most part "speculation"). The distinction to which attention is here called is one well recognized within the grain trade, one that is of fundamental significance from the public point of view, and one which accordingly deserves systematic reflection in the records kept of transactions in grain futures.



The 10 grain-futures exchanges that have been duly designated as "contract markets" have a combined membership of about 4,000. Each of these markets has either a clearing association or a clearing house, or some other arrangement which involves, on the part of certain members of the exchange, the making of certain reports to come central agency, and the filing thereby of these reports which thus come to be matters of record with the central agency. But in no case does this central agency make records of all the futures transactions of all the members of the exchange, nor in that degree of detail which is imposed upon members, either by business necessity or by the provisions of the grain futures act. Thus none of these agencies has any records of its own concerning any transactions between members of the exchange and nonmembers, which means that their records never show, except partially and incidentally, "the persons for whom" futures contracts are entered into. One of these agencies furthermore, namely the clearing house of the Board of Trade of the City of Chicago, has records only of amounts of money "owed" and "owing" as among members of the clearing house. It has in its possession no records regarding the nature or extent of the underlying transactions out of which these claims have arisen, e. g., records showing what property is covered by any transaction, as corn or wheat, the amount thereof, and its price. All such details, so far as concerns members of the clearing house of the Board of Trade of the City of Chicago, are recorded only by the members thereof. This is not the case at some other markets, for example, Minneapolis and Kansas City, where the clearing association regularly records or files for record, for each of its members, the kind and amount of grain to which the transactions in futures made and cleared by these members relate. In such markets, therefore, the records of the central agency show the total volume of purchases or sales, as measured in bushels, for each grain and for each delivery month, for each member of the clearing house, and also deliveries of grain made on contract, whereas these items are not recorded by the clearing house of the Board of Trade of the City of Chicago. On July 1, 1923, however, a regulation of the Chicago Board of Trade went into effect requiring members of the clearing house to report to the secretary of the board (a different functionary

from the manager of the clearing house) certain information with regard to deliveries. Since that time, to the extent that members have complied with the regulation, the secretary of the board has been in position to file such reports for record and to make records of deliveries, including, however, only records of grain put out on delivery, and thus showing the origin of deliveries but not records of grain taken in on delivery which would show the parties receiving the grain.

The foregoing discussion makes clear the fact that clearing associations and the like, though making certain records relating to transactions to which their own members are parties, do not record even for these members all the information required by the act to be recorded, and that for members of the exchanges who are not members of the clearing house the latter makes no records at all. Members of every exchange who do not hold memberships in the clearing house are in every case more numerous than those who do hold such membership. Thus the Board of Trade of the City of Chicago has approximately 1,600 members, all individuals, whereas the clearing house of the Board of Trade, composed of individuals, firms, and corporations, has less than 150 members.

#### PRESERVATION OF RECORDS

The act requires that the records contemplated by it shall be in permanent form, that they shall in all cases be preserved for a period of three years from the date of the transaction to which they relate, and that in some or all cases, if and as the Secretary of Agriculture shall so direct, they shall be preserved for a longer period. The Government regulations add nothing to this requirement by way of further specification. Inasmuch as the act has not yet been in force for three years, no occasion has yet arisen for extending by administrative order the period for which records shall be preserved.

#### ACCESSIBILITY OF RECORDS

The act provides that the records contemplated by it shall at all times be open to the inspection of any representative of the U. S. Department of Agriculture or the U. S. Department of Justice. The provision that the records shall be open to inspection "at all times" means that the accessibility of the records is not limited to such occasions as those on which some formal complaint for violation of the act has been served upon a person who



figures in the record. It also means that the records are to be accessible as soon as transactions are made and not merely after the lapse of time. Safeguards against the misuse of this accessibility are to be found in (1) its limitation to representatives of two departments of the United States Government, and (2) prohibition of the disclosure to the public by such representatives of "information which would separately disclose the business transactions of any person and trade secrets or names of customers." A proviso contained in the act qualifies this latter provision so far as it relates to the power of the Secretary of Agriculture to make public facts relating to persons found guilty, by prescribed procedure, of violating the provisions of the act.

As regards accessibility of records, the Government regulations require each member of a contract market to exhibit such records for inspection when and as requested by a representative of the U. S. Department of Agriculture authorized for the purpose by the officer in charge of the Grain Futures Administration. The effect of this regulation is to emphasize the public interest in such records, and to make it possible for a Federal representative to inspect at any time any records relating to any transaction, while at the same time safeguarding private interests against the abuse of the privilege of inspection. Thus the regulation, though consistent with the act, is somewhat more restricted, inasmuch as it requires exhibition of records not to "any" representative of the Department of Agriculture, but only to such representatives as have been specifically authorized for the purpose by a specified official. The regulations further prohibit such representatives from making known any facts regarding the business of a member of any contract market which may come to their knowledge through inspection of records, except as may be required by their official duties, or by a court of competent jurisdiction.

Up to the present time, in all markets combined, the authority to inspect records has been conferred upon six persons. All of these have inspected some records, usually for the purpose of discovering how such records are kept in order to enable the Grain Futures Administration to interpret properly the information furnished from such records by the reports to which a later part of this discussion is directed, and to verify those reports.

## COMPREHENSIVE INVESTIGATION

The grain futures act declares that the Secretary of Agriculture "shall investigate marketing conditions of grain and grain products" and that he may "make such investigation as he may deem necessary to ascertain the facts regarding the operations of boards of trade, whether prior or subsequent to the enactment of this act." The purposes of such investigation as stated in the act are to provide a basis for the efficient execution of the provisions of the act, and to provide information for the use of Congress and for the use of producers, consumers and distributors of grain and grain products.

### THE MAKING OF REPORTS—REQUIREMENTS OF THE ACT

In order to facilitate such investigation the original records of transactions, as already stated, are required to be open at all times to inspection by representatives of the Department of Agriculture, but in addition to this requirement there is a further requirement for the making and filing, by boards of trade or by their members, of reports based on these original records and on other available sources of information. The content, form, and frequency of these reports are left to the discretion of the Secretary of Agriculture, but the act provides that he may require them to show "the details and terms of all transactions entered into by the boards, or the members thereof," either in cash transactions or transactions for future delivery. The details referred to include all those with reference to which records are specifically provided for by the act. The discretion given to the Secretary of Agriculture is sufficiently wide to enable him to call either for standardized reports at regular intervals or for special reports at irregular intervals, either from boards of trade, as single entities, or from each member thereof.

In view of the fact that transactions in grain futures are "affected with a public interest," and in view of the further fact that the Government can promote this public interest properly only on the basis of adequate knowledge, the requirement that the opening of records to inspection shall be supplemented by the making and filing of reports comes to be, under prevailing conditions, both a logical and practical necessity. The Government could not obtain this adequate knowledge if it

were obliged to rely exclusively upon information gathered by its own agents from published sources, from interviews with the trade, and in particular from inspection of original records. This conclusion arises from four leading considerations, as follows: (1) Such records are voluminous and widely scattered; (2) they are necessarily technical; (3) the matters to which they relate, including the general market situation, are constantly undergoing rapid changes; (4) many of these matters are regarded as of the most confidential character.

(1) That the original records are both voluminous and scattered is sufficiently indicated by the fact that for the Chicago Board of Trade alone the original records of transactions in grain futures, covering the details specified by the act, including the persons for whom such transactions are entered into, could be inspected only by consulting the books of several hundred firms, located in larger or smaller cities scattered all over the United States. This situation arises from the fact that each of the 1,600 members of the Chicago Board of Trade may handle transactions in futures either for his own account or for the account of customers, and many such members are located in States other than Illinois and in countries other than the United States. The geographical distribution of members listed in the published "List of Members of the Board of Trade of the City of Chicago" (June 12, 1924) was as follows:

TABLE 1.—*Geographical distribution of membership of the Board of Trade of the City of Chicago*

England.....	6	Michigan.....	3
Holland.....	1	Minnesota.....	44
Alberta.....	1	Missouri.....	50
British Columbia..	3	Montana.....	2
Manitoba.....	12	Nebraska.....	14
Ontario.....	5	New Jersey.....	1
Quebec.....	4	New York.....	148
Alabama.....	1	North Carolina..	2
Arkansas.....	4	Ohio.....	23
California.....	11	Oklahoma.....	4
Colorado.....	3	Oregon.....	1
District of Colum- bia.....	1	Pennsylvania.....	13
Florida.....	1	South Dakota.....	2
Georgia.....	1	Tennessee.....	10
Idaho.....	1	Texas.....	5
Illinois.....	1,100	Utah.....	1
Indiana.....	17	Vermont.....	1
Iowa.....	14	Virginia.....	3
Kansas.....	3	Washington.....	1
Kentucky.....	7	West Virginia..	2
Louisiana.....	10	Wisconsin.....	9
Maryland.....	9	No address.....	28
Massachusetts.....	10		
		Total.....	1,592

Some of these members have no "customers," but others have hundreds of "customers," and some have thou-

sands. A canvas of members made in October and November, 1923, showed them to have more than 400 offices located in 33 different States, in addition to a large number of widely scattered "correspondents." These figures will suggest the difficulty of obtaining anything like comprehensive information by attempting to rely entirely on the method of inspection.

(2) The records now kept of transactions in grain futures are not in themselves very complicated, but anyone who wishes to obtain significant information from them must have a good general understanding of the technique of futures trading. Men may know the principles of bookkeeping or be entirely familiar with the handling of cash grain and yet be unable from inspection of the records of a grain-futures commission house to obtain the significant information that these records contain, or to formulate inquiries that would bring forth the true interpretation of the records. Complications arise from a variety of ways in which "net positions" may be calculated and "settlements" brought about, and from variations among different firms in the way in which the same fact is recorded. The necessary technical knowledge is not in possession of persons inexperienced in respect to futures trading, and consequently the building up of a staff of competent employees large enough to cover all the records is to be contemplated only as a last resort, if at all.

(3) The rapidity with which changes take place in the matters to which the records of futures trading relate is extreme. Thus, many trades are closed out on the same day that they are opened, others on the next day, and either a single trader or an entire group of traders may change his or its position from "long" to "short" from one day to another or even from hour to hour, or from minute to minute within a single day. Under such conditions no comprehensive or well-balanced view of the state of the market could ever be had, even by using an army of inspectors, if the latter were obliged to get all their information solely from the original records. Before they succeeded in arriving at the facts for any given date, many months would have passed and the findings would be completely out of date.

(4) Finally, there are few business transactions which are more confidentially regarded by those concerned in them than those involving grain futures. Many firms and many customers jealously guard their operations



from everybody, sometimes because of a desire to avoid public knowledge of their presence in the market, as for fear that it would injure their financial standing, or more often because they fear that any knowledge of their current operations by anybody else is likely to lead to undesired competition or other results that would limit their profit or subject them to loss.

These considerations render it imperative that the Government assemble most of the statistical information that it needs through the medium of summary reports prepared from the original records by parties already trusted with them and already familiar with them. To the extent that such reports serve the purpose, inspection of books, except for purposes of verification and amplification, is reduced to a minimum.

#### THE MAKING OF REPORTS—GOVERNMENT REGULATIONS

The alternatives confronting the Government with regard to summary reports are, under the terms of the act, both numerous and varied. Such reports may be required (1) from every member of a contract market or from some agency or set of agencies reporting "for" members; (2) in regular or special form and at irregular or periodic intervals, frequently or infrequently; and (3) with respect to any or all of the details and terms of any or all transactions (involving members) in grain futures or in cash grain, or in both.

Which of the various alternatives within the scope of these provisions will best promote the public interest is a question to which the Grain Futures Administration has been obliged to give most careful attention and upon which it has also been obliged to obtain light by a process of cautious and continuing experiment.

#### SOURCES AND CONTENTS OF REPORTS

The first question is from whom shall reports be required? The alternatives here are about three in number, as follows:

(a) From every member of every "contract market," or about 4,000 persons.

(b) From one or more classes of members—e. g., all members located in certain important centers, such as Chicago, New York, Minneapolis, Kansas City, Buffalo; or all members handling, either for their own account or for the account of others, more than a certain volume of business; or all

members doing a certain class of business, such as a commission business in grain futures (commission houses), or such as a "clearing" business (members of an exchange who are also members of the clearing house of that exchange).

(c) From some central agency acting as reporter for some or all members in respect to some or all matters involved in futures transactions, such as the secretary of the exchange or the manager of the clearing house.

The simplest of these three alternatives is the last one, viz., to have reports made to the Grain Futures Administration by the manager of the clearing house. This alternative has in fact been employed to some extent, notably at Kansas City and Milwaukee, where they have full-fledged clearing houses and where the members thereof preferred to have the clearing house make some of their reports for them. Reports from the clearing house give for each member of the clearing house, by futures, the total bought and the total sold. Inasmuch as all trades, for whomsoever made, must be made in the name of some member of the clearing house, these summary reports can be utilized for determining the *total volume of trading* for the period to which they relate, such as one day, one week, or one month. They can also be used for the purpose of analyzing transactions between and among such "clearing members." Thus these "clearing members" can all be ranked in the order of the volume of trading which each of them handles, houses which have been predominantly on the buying side for the period in question can be listed and contrasted with a similar list of houses which have been predominantly on the selling side, "long" houses may be distinguished from "short" houses, and the extent to which "long" or "short" commitments ("on the street") have been concentrated in the hands of a few houses or distributed among many houses can be ascertained. In a few cases, when the class of business (as principally speculative or principally nonspeculative) is known, and is found to be homogeneous, the trades made during any period and the commitments on some given date can be to some extent ascribed to their appropriate class. From these same summary reports some useful and comprehensive data on deliveries can also be obtained. But useful as the items here enumerated are, they do not include some of the items which are of most importance, and such summary clearing house reports as have been



described can not therefore serve as an exclusive reliance. What some of these items are will become evident from the discussion that follows of the situation on the Board of Trade of the City of Chicago.

For the Board of Trade of the City of Chicago, for reasons already explained, the reports made by "clearing members" to the manager of the clearing house do not put him in position to report to the Grain Futures Administration in summary fashion any information concerning the *amount of trading*, either purchases or sales, for any "clearing member" or for all "clearing members" combined. Neither is he informed, in his official capacity or by regular reports made to him by clearing members, concerning their "*market position*" at any time, as "long" or "short," or concerning *deliveries*. At Chicago, therefore, none of that information is available in summary form through the clearing house which in certain other markets is promptly available from this source. At Chicago, consequently, reports from each "clearing member" made directly to the Grain Futures Administration have had to be required in order to make this information available, as well as for other purposes, and the compilation and tabulation thereof has had to be assumed by the Government. To some extent, therefore, these reports contain information such as has already been included for years in a regular and routine way in the reports made daily by "clearing members" of other exchanges to their respective clearing associations.

Some of the items required by the Government regulations to be included in the reports regularly made by individual clearing members of the Chicago Board of Trade are of this character and others are of different character. The first four of the six items so required, as embodied in article 2 of the Government regulations, are as follows: (a) Net position at the beginning of the period covered by the report; (b) the quantity of grain purchased and the quantity of grain sold on futures contracts during the period covered by the report; (c) The quantity of grain delivered and the quantity of grain received on such contracts during the period covered by the report; (d) The net position at the end of the period covered by the report.

To the extent indicated by these four items the regular reports made by individual "clearing members" at Chicago (i. e., members of the clearing

house of the Board of Trade of the City of Chicago) merely put the Grain Futures Administration in possession of the same information relative to that market that would be available at the Chicago Board of Trade Clearing House if the latter were of the usual or complete type. They can be used for the same purposes and are subject to the same limitations. These same items are also reported by "clearing members" of the exchanges at Minneapolis, Duluth, St. Louis, Los Angeles, and San Francisco.

But neither clearing-house reports nor reports by "clearing members" made solely for clearing purposes contain, except incidentally, information concerning "the persons for whom" transactions in grain futures are entered into. For this reason the Government regulations require reports directly from each "clearing member" in every important contract market, about 275 firms in all, whether such market has a clearing house of the complete type or of the incomplete type, such reports to include two other items of information which will be specified and discussed in order.

The first of these items as described by Government regulation 2 (e) is the aggregate of all "long" and the aggregate of all "short" accounts carried at the end of the period covered by the report by the clearing member for whom the report is made. The effect of this requirement (and of the one next to be discussed) is to put the Government in possession of certain information which has not heretofore been, and is not now, made available to the managers of clearing houses by the regular routine of clearing and which never comes to their notice except in some unofficial or incidental way. The nature of the information called for by regulation 2 (e) and the reasons which have led the Grain Futures Administration to ask for this information need to be carefully set forth, partly because some very technical matters are involved and partly because the matter is peculiarly susceptible to misunderstanding.

The "net position" of each "clearing member," as disclosed by such reports as are made to a full-fledged clearing house and as specified in the preceding discussion, is the technical designation applied to the number of bushels of each grain by which the member's outstanding commitments on the "bought" side exceed (or fall short of) its commitments on the "sold" side. Thus a house which has bought 2,000,000 bushels of corn for future de-

livery and sold 1,000,000 bushels has a net position of 1,000,000 bushels "long," against which, as shown by the records of the clearing house, one or more other "clearing members" hold a net position, similarly ascertained, of 1,000,000 bushels "short."

But inasmuch as almost every "clearing member" carries accounts for "customers," as well as (in some cases) for itself, the total purchases and total sales made by that "clearing member" represent many transactions made "for" other persons, some of whom will have a net position (with the firm) on the "long" side while others have a net position on the "short" side. Thus it would be possible, in the instance cited, for the firm having a net position of 1,000,000 bushels "long" to be carrying on its books for "customers" 10 "long" accounts aggregating 2,000,000 bushels and 5 "short" accounts aggregating 1,000,000 bushels. The difference between these items, or 1,000,000 bushels, constitutes the firm's net position (in relation to the clearing house or to the other members thereof), and can be derived for the firm (as illustrated) by subtraction of the aggregate of all its "short" accounts from the aggregate of all its "long" accounts. These aggregates, however, can not of course be derived from the figure representing the clearing member's net position as specified by items (a) and (d) on the list already set forth.

The first use to be made of figures showing firm by firm the aggregate of each firm's "long" accounts and the aggregate of its "short" accounts is to combine the items into totals, thus obtaining aggregates for the market as a whole. Similar combination of the net position figures (regulation 2 (a) or 2 (d)) is also in order. The two totals, which represent different things, are thus seen to differ considerably in amount. Thus, taking for illustration Minneapolis figures relating to wheat futures at the close of business on June 30, 1924, the "aggregate" of all "long" accounts carried by all "clearing members," as reported under regulation 2 (e), amounted to 11,016,000 bushels, whereas the sum of the net positions of all "clearing members," as reported under regulation 2 (d), amounted to only 6,873,000 bushels. The difference, 4,143,000 bushels, represented commitments that "offset" each other after the manner already explained. For the Chicago Board of Trade the corresponding items (for December 31, 1923) were 95,436,000 bushels and 77,818,000 bushels. The smaller figure of each of these pairs of items represents

"net positions" or net commitments (all clearing members combined, "street position"), and the larger represents "open interests" ("customers'" open interests).

The designations used for these different items in the foregoing paragraph and throughout this report need to be carefully observed because they are not altogether self-explanatory. Their meaning is explained elsewhere in this report. For present purposes, however, it will be sufficient to note that a certain item representing open interests is said to represent the "customers'" open interest in order to distinguish it from another item representing the "true" or "ultimate" open interest of which it falls short by a considerable amount. This is because some of the "customers" of some "clearing members" are themselves engaged in a grain-futures commission business, and these "customers" accordingly have offsetting accounts on their own books. Thus, in the instance cited, one of the 5 accounts assumed to be "short" (in the aggregate), 1,000,000 bushels may have been a "commission house" account, in itself "net short" 100,000 bushels, whereas that "commission house" may itself have, say, 10 customers, of whom 5 are "net long" (in the aggregate) 800,000 bushels, while the other 5 are "net short" (in the aggregate) 900,000 bushels. Inasmuch as all the trades for all 10 of these accounts have been booked by the "clearing member" in the name of the "commission house customer," only the "net position" of this particular account and *not* the "open interest" of its customers gets reported by the "clearing member." The fact that commission houses figure among the (so-called) "customers" of "clearing members" thus renders the aggregate "customers'" open interest (a known item) smaller than the "true" open interest (an item unknown).

The principal reason why the latter figure is still unknown to the Grain Futures Administration is because it is unknown to the clearing members who now make reports and because direct reports from commission houses not belonging to the clearing house of any exchange have not yet been required. The number of such houses runs into the hundreds, counting the brokerage concerns in the various cities of the country (outside the cities in which the futures markets are located) and allowing for the known fact that a commission may be a "customer" of a second commission house which is itself a "customer" of a third, and so on, only the last house in the chain being a

"clearing member." Such clearing member naturally does not know the market standing of the ultimate customers of the first and other houses in the chain.

Many significant uses can be made of a figure showing aggregate open interests for any given market as a whole or for all markets taken together. Two such uses may be briefly suggested here. Thus there has been much public discussion both inside and outside the exchanges concerning the influence on the market exerted by traders in grain futures whose operations are upon a large scale. There is no satisfactory way of measuring the effect of large-scale operations except in relation to the total of which they form a part. Similarly, the shrinkage of the open interest which normally occurs in every future, e. g., May wheat, toward the end of the "life" of the future and which sometimes involves a concentration of holdings which may or may not portend a "corner," can obviously be measured and its consequences foreseen only if the total of open interests is known.

The second of the two important items of information uniformly required directly from individual "clearing members" is that specified by regulation 2(f), the net position, at the end of the period covered by the report, of each *separate account* carried by such clearing member, when such net position equals or exceeds a certain amount. The accounts here referred to must be reported by symbol, not by name. The "amount" referred to is not specified in the regulations, but is specified from time to time in a written notice by the Grain Futures Administration. It differs for different grains and different markets. For each of the principal markets, and for each grain, the amount so specified at present is as shown in Table 2.

The significance of this requirement embodied in regulation 2 (f) is to be viewed in the light of the detailed discussion of records and reports which has been presented on preceding pages. Thus, attention has been specially called to the fact that all transactions in grain futures are affected with a public interest, a fact which dictates the character of reports as well as the character of records. The fact has also been pointed out that the records which are most accessible do not contain all the information regarding such transactions, in particular the information regarding transactions by so-called ultimate traders, and that the reports most easily made (e. g., those made by the clearing house or by clearing members) are necessarily based on records which are similarly incomplete with regard to this same matter. Government regulation 2 (f) represents a step made by the Grain Futures Administration toward acquiring facts with reference to the truly basic situation.

The present regulation relating to reports on "special accounts" represents, however, but a limited step in the direction indicated. This is made evident by a precise analysis of the requirements of the regulation as follows:

(1.) Regulation 2 (f), in its present form, requires reports on "special accounts" from "clearing members" only. Thus, "special accounts" carried by "outside commission houses," whether such accounts be for ultimate traders or for other commission houses, are not required to be reported by the present regulation.

(2.) Regulation 2 (f) recognizes the fact that accounts are kept (a) for each separate customer, (b) for each separate grain, and (c) for each future; e. g., May wheat, September corn. Thus this regulation has been officially interpreted to mean that a clearing member must report any account as a "special

TABLE 2.—Designated amounts <sup>1</sup> at or above which net position of "customers' " accounts are required to be reported separately

Market	Wheat futures	Corn futures	Oats futures	Rye futures	Barley futures	Flax futures
	<i>Bushels</i>	<i>Bushels</i>	<i>Bushels</i>	<i>Bushels</i>	<i>Bushels</i>	<i>Bushels</i>
Chicago Board of Trade.....	500,000	500,000	500,000	200,000	200,000	-----
Chicago Open Board.....	50,000	50,000	50,000	50,000	-----	-----
Minneapolis.....	500,000	200,000	200,000	200,000	200,000	50,000
Duluth.....	500,000	200,000	200,000	200,000	200,000	50,000
Kansas City.....	250,000	250,000	250,000	-----	-----	-----
St. Louis.....	250,000	250,000	250,000	-----	-----	-----
Milwaukee.....	50,000	50,000	50,000	50,000	50,000	50,000

<sup>1</sup> Any of these amounts is subject to change at any time by written notice from the Grain Futures Administration.



account" when and only when it shows a "long" or "short" position of the designated amount (e. g., 500,000 bushels) in some *one future*; e. g., May wheat or July wheat. This means that any account "long" or "short" less than, say, 500,000 bushels, in any *one future* (e. g., "long" 400,000 May wheat) does not need to be reported, even though a "long" or "short" interest for the same customer in *another future* be large enough (e. g., "long" 400,000 July wheat) to make his "position" in the two futures combined "long" or "short" by the designated amount (e. g., in the instance cited, "long" 800,000 bushels). This ruling does serve, however, to bring in reports on some accounts which represent "spreads between months;" e. g., an account "long" (or "short") as much as 500,000 bushels in one future and at the same time "short" (or "long") as much as 500,000 bushels in another. Furthermore, an account becomes a "special account," to be reported under the regulation, when it shows for instance, a "long" position of 500,000 bushels in May wheat at one market (e. g., Chicago) even though this may be offset by, say, 300,000 bushels "short" in another future (e. g., July wheat) in the same market, or in the same future in some other market (e. g., "short" 300,000 May wheat, Kansas City, or Winnipeg). Thus at least one end of some "spreads" between markets" is reported, though which of the reported "special accounts" are of this character can be ascertained only by obtaining supplementary information not carried on the face of the report.

(3) Regulation 2 (f) requires reports only for accounts which show a net position equal to or in excess of a certain amount (e. g., 500,000 bushels), and only during such time or times as they show such position. Accounts which stand at times "long" or "short" as much as 500,000 bushels, or whatever other amount may be regularly specified, at times fall below this level and need not be separately reported during these latter intervals.

Regulation 2 (f) puts no limit on the amount of trading which any person may carry on or upon the size of any trader's net position.

It is evident from the foregoing analysis that the step already made toward the current collection of fundamental data by summary daily reports does not suffice fully to inform the Grain Futures Administration concerning the so-called "technical position of the market."

Net-position reports for "special accounts" are required to be made by symbol, using the same symbol for a given customer until a change is authorized by the Grain Futures Administration. The purpose of the provision for reports *by symbol only*, and of certain other provisions, is to guard the confidential character of the information as is more fully indicated in a later section of this report.

During the year ended June 30, 1924, for the Chicago Board of Trade, 105 special accounts have been reported for wheat futures under regulation 2 (f), from 27 different "clearing members," 43 for corn futures from 18 "clearing members," 9 for oats futures from 7 "clearing members," and 25 for rye futures from 12 "clearing members." These special accounts so reported have, in every case, included a number of "outside commission houses" as well as a number of individual "hedgers" or "speculators."

The making of regular reports on "special accounts" was looked upon by the trade when first proposed as a new departure in exchange practice. Certain reports of similar character had at times and on occasion been asked for by the officials of the Chicago Board of Trade, but only as part of some inquiry into a specific charge of alleged misconduct by some member of the exchange, such as might, if proved, result under the rules of the exchange in the loss or suspension of trading privileges by the accused. As a matter of history, therefore, "investigation" had come to be looked upon as an occasional affair, not a regular and continuous one, and as something designed to disclose or to "detect" punishable misbehavior on the part of persons accused thereof. Investigation as a continuous affair, designed to assemble facts of practical or scientific import, was a novel idea to the trade and one which the trade has been somewhat slow to appreciate.

Appreciation of this idea has been making headway in the trade, however, during the last year or more. One circumstance which served to gain for it more favorable consideration among the members of the exchanges was the behavior of the market upon the single occasion, before the promulgation of the Government regulations, when the Grain Futures Administration tested the practicability of the alternative procedure, i. e., the making of a "call" upon a special occasion. Thus all clearing members were asked on June 1, 1923, to report to the Grain

Futures Administration the net position of each of their accounts in wheat futures which was at the close of the preceding day either "long" or "short" as much as 1,000,000 bushels. The fact that the "call" had been made, although not published by the Grain Futures Administration, became within a few minutes a subject for conjecture and for the circulation of rumors concerning the motives and intentions of the Grain Future Administration and the probable consequences of its action. Some of these rumors reported that the Government was about to force some of the "shorts" to cover, or had forced some of them to do so, while other rumors were that the Grain Futures Administration was about to embark on an unpredictable policy of interfering with the course of the market whenever in its judgment market prices were moving in ways that seemed to it to be suspicious. Such rumors naturally operated to unsettle the market. Both the conjectures and the rumors grew principally out of the ingrained habit of regarding any "investigation" as a phase of "criminal procedure." The result was to demonstrate marketwise the undesirability of relying upon the "occasional call" as a substitute for the present method of obtaining the sort of information covered by regulation 2 (f). The view sponsored by the Grain Futures Administration accordingly gathered strength in exchange circles, namely, the view that the proper way to assemble such information is regularly, continuously, and as a routine matter. It thus comes to be taken marketwise as a matter of course. When so gathered, over a considerable period of time, it is believed that such information will not only ballast the judgment of the grain exchange supervisors but will afford a more adequate basis for constructive proposals relating to the rules of the exchanges, to the Government regulations, and to the grain futures act than has ever before been available. Some of the information already assembled in this way is exhibited and discussed in other parts of this report.

#### FREQUENCY OF REPORTS

The present Government regulations with regard to the frequency of the reports, like the other regulations already discussed, embody the view of the Grain Futures Administration that the continuous collection of facts regarding the workings of the grain-futures markets is its primary function.

Those reports are at all markets on a daily basis, even at one market (Baltimore) where the reports are not in fact submitted daily. At Baltimore the volume of business done in grain futures in a year amounts to less than 5 per cent of that done in Chicago in a day, and reports are made weekly, but they give the information for each day of the week. At all the other markets—Chicago, Minneapolis, Duluth, Kansas City, St. Louis, Milwaukee, Los Angeles, and San Francisco—the reports are not only on a daily basis, but they are also submitted daily to the Grain Futures Administration.

The propriety of daily reports as against weekly or monthly reports has been much debated among members of the exchanges. It will be unnecessary to detail the arguments employed because the proper determination of the question is being submitted to the test of experience. Three considerations, however, may advantageously be recorded here, because all three of them are of continuing importance:

(1) The market situation is a constantly changing one, not only from month to month and from day to day, but even from hour to hour and at times from minute to minute. No fact is better known to those who make a regular practice of trading in grain futures for speculative purposes. Some such traders spend large sums to insure that their information, e. g., crop information, will be altogether up to date. If the Government is to be well informed it must have daily information.

(2) The "market gossip" which goes over the wires of the news agencies and the larger grain-futures commission houses, which runs in an almost continuous stream during trading hours, and which conveys or foreshadows almost all the market information that the average trader uses for determining his trading policy, frequently contains statements with regard to who is selling, who is buying, "accumulation," "liquidation," and a variety of other matters of similar nature. Both the accuracy of these statements and the integrity of those who assume responsibility for them are questions of instant moment to traders, which they often undertake to resolve in their own way, by the quickest available means. That the "quality" of much of this "gossip" has long been under suspicion in trade circles is an open secret. If the Grain Futures Administration is to be in position to determine the "quality" of "gossip," then it should have reliable information from authentic sources when the gossip is circu-



lating and with reference to as many as possible of the precise matters to which this gossip relates. Daily reports would seem to be none too frequent to serve this purpose, while weekly or monthly reports would be obviously unsatisfactory except for statistical purposes.

(2) The general public, in the sense of the people who read the daily newspapers, who have an interest in the "market news," and who are in position to express any views they may form regarding the behavior of grain-futures markets, have acquired, rightly or wrongly, the suspicion that frequent cases of improper business conduct occur on grain-futures exchanges and that parties financially interested in these exchanges can not always be trusted to tell the truth about such cases. It remains to be seen to what extent, if at all, this popular suspicion is justified, but in the meantime the Grain Futures Administration, as a Government agency, instituted by Congress for the purpose, is naturally looked upon by the general public as being actually or potentially in position to know all the relevant facts, to speak in public with authority and impartiality concerning them, and to speak promptly. The reports made by the trade to the Grain Futures Administration must, therefore, be frequent and up to date, as well as complete.

#### AUTHORIZED PUBLICITY

The grain futures act requires that the Secretary of Agriculture, upon the basis of investigation, shall furnish "to producers, consumers, and distributors" information respecting the grain markets and conditions that affect these markets. This is a mandatory requirement. Another provision declares that the Secretary of Agriculture may publish information gathered from his investigation into the operations of boards of trade. He is specifically authorized, furthermore, to issue such reports as he may deem necessary relative to the conduct of any board of trade or the transactions of any person found guilty, by prescribed procedure, of violating the provisions of the act. On the other hand, safeguards against the publication of information likely to affect adversely the interests of law-abiding citizens are contained in the provision that publicity shall not, under ordinary circumstances, be given to "data or information which would separately disclose the business transactions of any person and trade secrets or names

of customers." The Government regulations issued for the guidance of members of "contract markets" have borne definite relation to these provisions of the act.

The limitations imposed by the act are reiterated in section 4 of the regulations, which reads as follows:

No representative of the Department of Agriculture shall, without the consent of the member, divulge or make known in any manner, except in so far as such representative may be required in order to perform his official duties or by a court of competent jurisdiction, any facts or information regarding the business of a member of a contract market which may come to the knowledge of such representative through any inspection or examination of the reports or records of, or through any information given by, such member pursuant to the act and these rules and regulations.

One of the principal effects of this statement is to advertise the fact that limitations set by law with regard to the disclosure of information are of a sort designed to protect individuals in their dealings with one another. Another effect is to advertise the disposition of the Grain Futures Administration to observe these limitations. A barrier is thus set up against certain forms of publicity that might be considered inadvertent, unauthorized, and calculated to serve no legitimate public purpose.

Similar barriers are set up by several other arrangements, some of which are not mentioned in the Government regulations. Thus daily reports are all submitted on uniform blank forms furnished by the Grain Futures Administration. Each "clearing member" of each of the larger markets is given a number by which to designate reports on these forms in place of the name of the firm. The key to the numbers is known only to a very few persons, usually limited to the grain exchange supervisor and one or two representatives of the supervisor whose duties require them to know the name of the firm to which a given number corresponds in order to be able to follow up late reports or verify inaccurate reports. These reports come into the hands of these particular representatives without passing through any hands other than those of the reporting firms' clerks and messengers.

The reports are stored under lock and key in a safe place to which no one but the supervisor and these representatives have access, and from which they are never removed except by and under the custody of these representatives. The latter list on special forms some of the information which the daily reports contain, and the resulting lists are similarly safeguarded. Whenever the original reports are being used as a basis for the compilation of



MARCH                      APRIL                      MAY  
 10 13 16 19 22 24 27 29 31    3 5 7 10 12 15 18 20 22 25 27 29    2 4 6 9 11 13 16 18 20 23 25 27 31

# GOOD OF TRADE IN 1922 MAY WHEAT



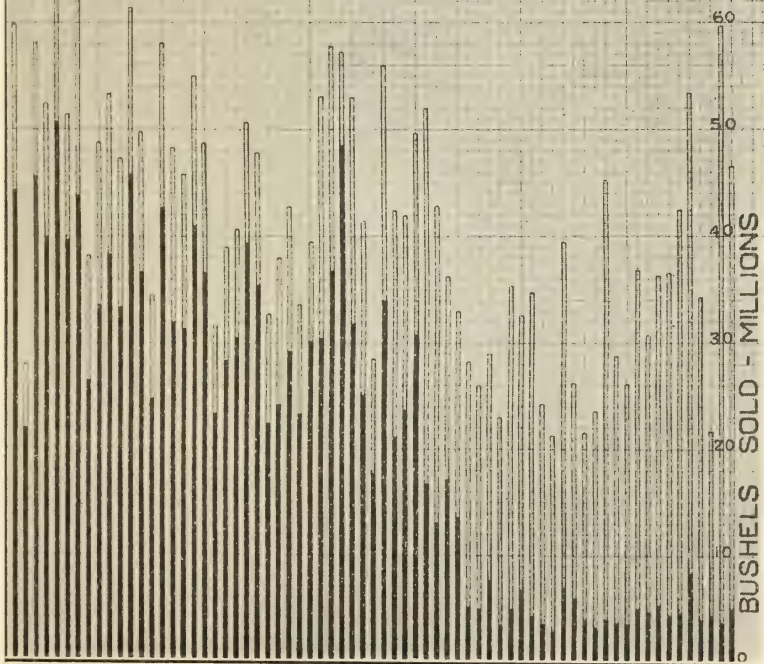
AUGUST 24, 1921 TO MAY 31, 1922.

TOTAL SALES BUSHELS

MAY WHEAT 6,075,842,000

ALL WHEAT } 10,225,175,000  
 FUTURES }

CHICAGO  
 BOARD OF TRADE





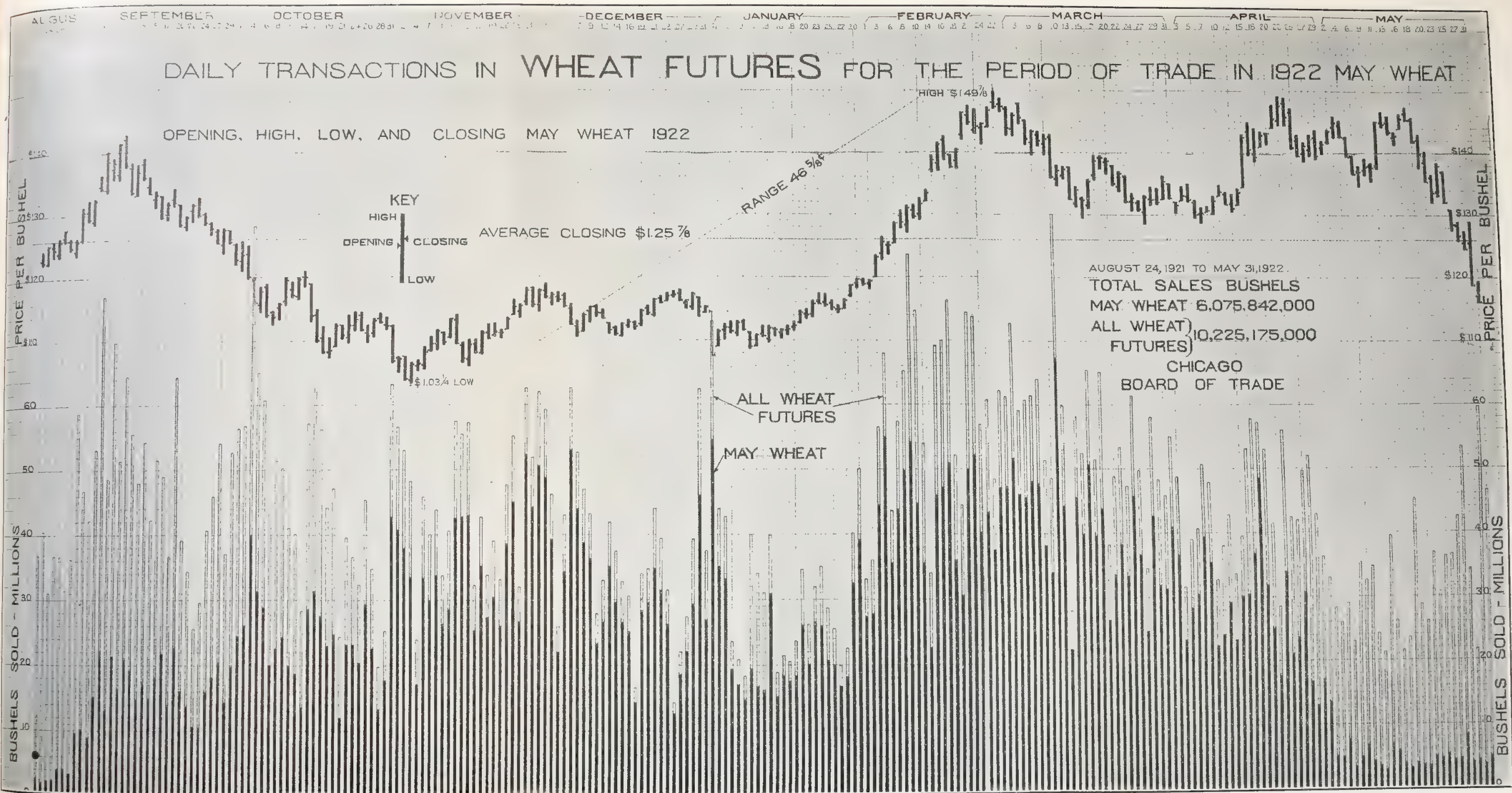


FIG. 1

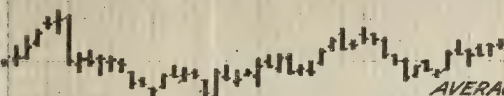




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MARCH 1 3 5 7 9 11 13 15 17 19 21 23 25 27 29

## DE IN 1923 MAY WHEAT

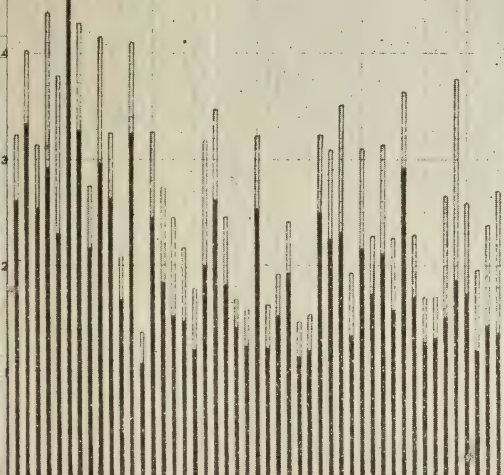
PRICE PER BUSHEL



AUGUST 1, 1922 TO MAY 31, 1923  
TOTAL SALES-BUSHEL  
MAY WHEAT 3,704,518,000.  
ALL WHEAT } 7,949,041,000  
FUTURES }

CHICAGO

BUSHEL SOLD-MILLIONS







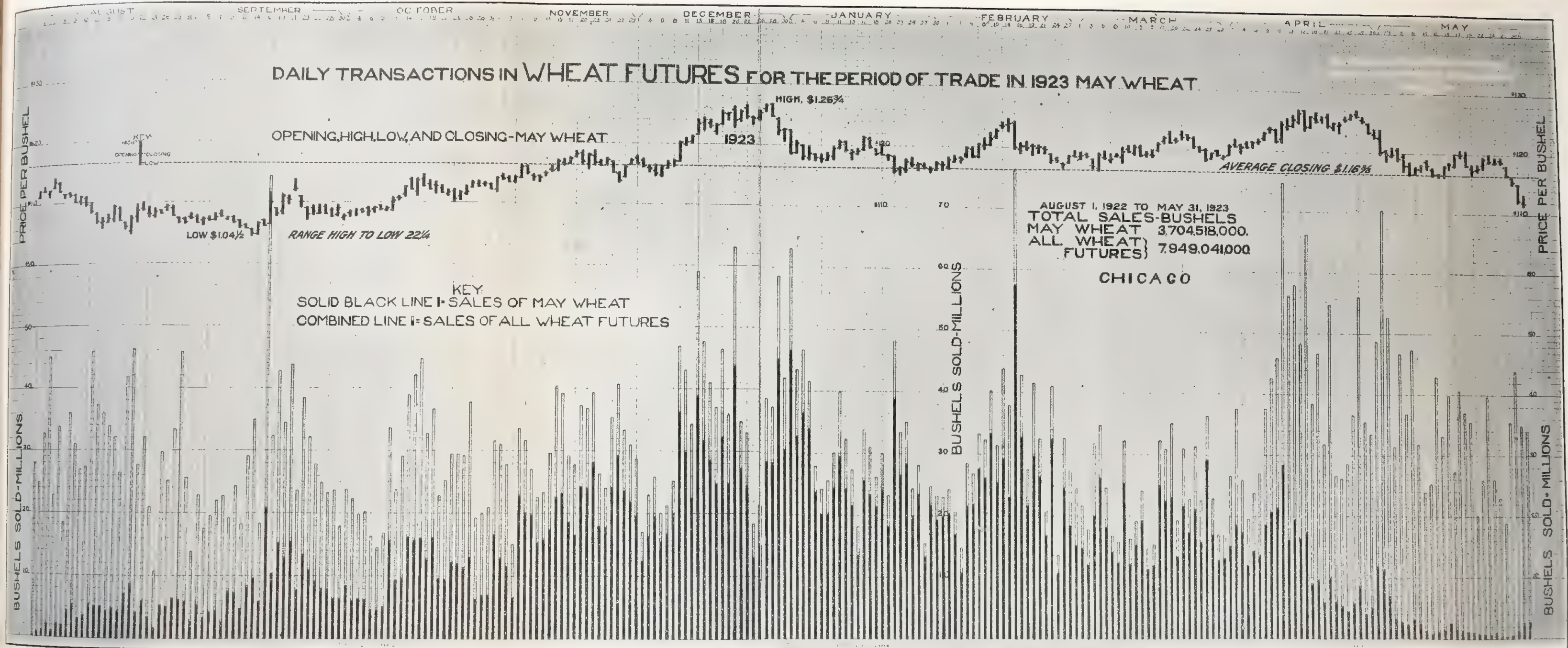


FIG. 2

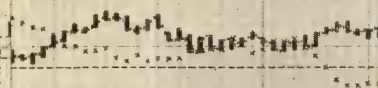


# FEBRUARY

25 28 30 4 6 8 11 14 16 19 21 25 27 29 3 5 7

## TRADE IN 1924 MAY

PRICE PER BUSHEL



MAY 31, 1924

BUSHEL

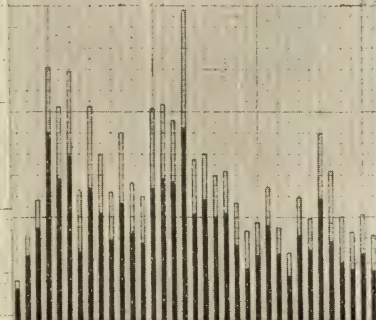
2,037,720,000

RES

5,145,360,000

TOTAL OF ALL OPEN  
DE ONLY, AS REPORTED  
BERS UNDER ARTICLE  
REGULATIONS.

BUSHEL SOLD - MILLIONS







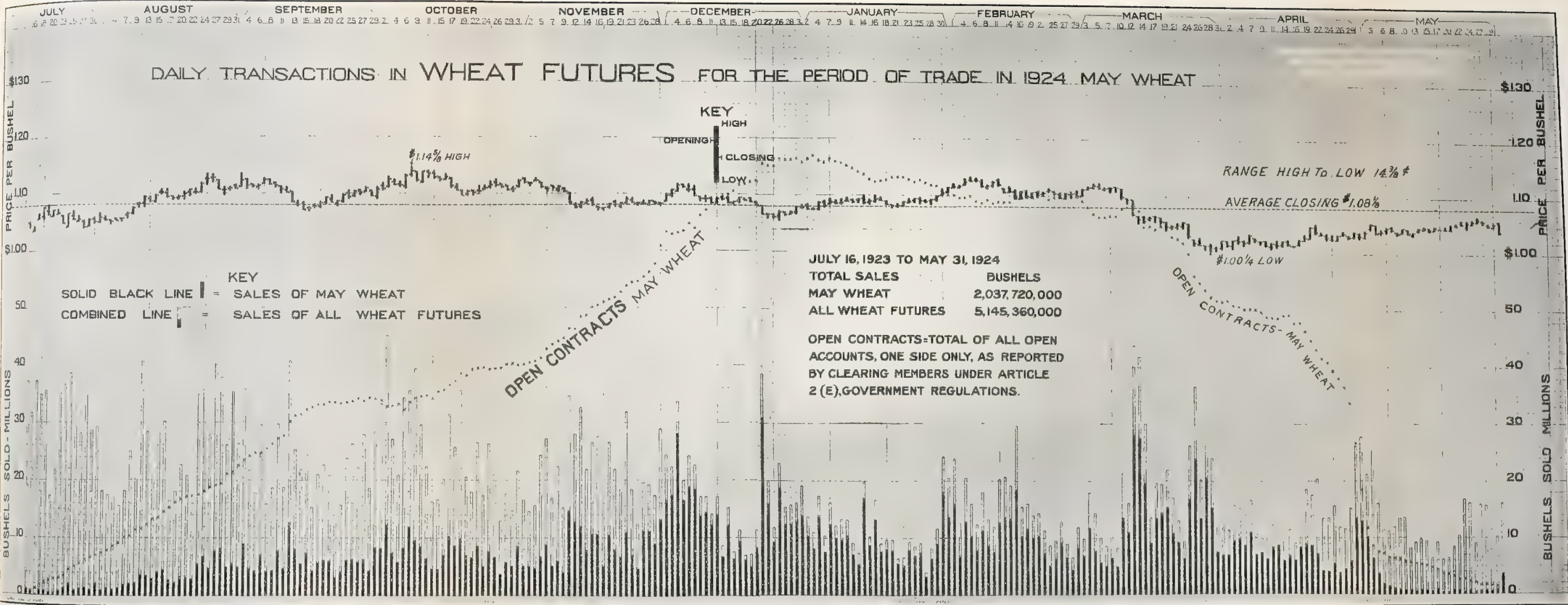


FIG. 3





statistical data, the work is done by tested and seasoned members of the clerical staff and without the use of any record of the names of any firms at any stage of the process.

A somewhat more rigid procedure is followed with reference to the reports of net position for "customers'" accounts. The latter are required by the regulations to be reported by symbol. The name for which any given symbol stands is not permitted to appear on the report. Any compilations based on these reports for "special accounts" are made by the supervisor himself or by seasoned clerks who are not informed with regard to the identity of any such account or as to the result of any current aggregation of such accounts. Furthermore, the symbols used are subject to change, with the approval in each case of the grain exchange supervisor, and are not infrequently changed. The key to the symbols is known only to the grain exchange supervisor, and is not "in the files."

This explanation will make evident the nature of the precautions taken to avoid inadvertent disclosure of the contents of daily reports, or what has been referred to as "unauthorized" or unstudied publicity such as would serve no public purpose. The intent underlying this and other features of administrative procedure is to guard the daily reports after they reach the Grain Futures Administration with considerably more care than such information is guarded among the personnel of the offices of the "clearing members" themselves.

Authorized and studied publicity, however, is an entirely different matter, for which the grain futures act makes specific provision and which is controlled in fact by the Secretary of Agriculture himself, by the assistant to the Secretary in charge of the Grain Futures Administration, and by the grain exchange supervisor at Chicago. The nature, extent, and purposes of such authorized and studied publicity will now be discussed on the basis of illustrations drawn from the history of the year 1923-24.

During this year almost all the publicity that has been authorized and given to information assembled by the Grain Futures Administration has been in numerical form, and chiefly in the form of aggregates and averages, with a limited amount of accompanying text confined entirely to explanatory matter, excluding both interpretation and conclusions. The published figures

have related almost altogether to two matters—first, volume of trading in grain futures, and second, "customers'" open interests. The publicity given to each of these two classes of information will be illustrated and discussed in the following pages. Information concerning the volume of trading has been published in daily newspapers, in trade journals, in U. S. Department of Agriculture Statistical Bulletin No. 6 (now in press), and in Senate Document No. 110, Sixty-eighth Congress, first session. Information concerning open interests appeared in the latter publication and in part in such newspapers, trade journals, etc., as published extracts therefrom. It bears the title "Trading in Grain Futures" and represents the response of the Secretary of Agriculture to Senate Resolution No. 9, adopted by the Senate on January 8, 1924. The resolution directed the Secretary of Agriculture to ascertain certain facts through the Grain Futures Administration and "promptly publish the findings," but "without opinions by the investigators."

#### PUBLICITY CONCERNING THE VOLUME OF TRADING IN GRAIN FUTURES

The first statistical material published by the Grain Futures Administration was released for publication at Chicago on November 20, 1923, and consisted of a chart showing for May wheat (1923), Chicago Board of Trade, for the "life" of the future, for each day of such "life," covering the period August 13, 1922, to May 31, 1923, the volume of trading, and the opening, high, low, and closing price quotations. Similar charts relating to May wheat (1922) and May wheat (1924) are about to be released as this annual report is in preparation. All three of these charts (figs. 1, 2, and 3) are reproduced herewith. The chart for May, 1924, wheat includes data on "open contracts," of which the precise significance is discussed on pages 18, 19, and 20.

On December 4, 1923, there was released for publication at Chicago a statement giving for the month of November, 1923, the total volume of trading in grain futures by grains. This statement is here reproduced, because it illustrates the first occasion on which information of this character has ever been published while still a matter of current public interest.

*Board of Trade of the City of Chicago*  
*volume of trading in grain futures*  
*during the month of November, 1923*

[In thousands of bushels, i. e., 000 omitted]

Wheat futures.....	553, 850
Corn futures.....	355, 588
Oats futures.....	40, 414
Rye futures.....	18, 381
All grains.....	968, 233

After the release of this first table similar tables began to be released for publication early in every month relating to the preceding month. Since April, 1924, these tables have included, on a monthly basis, the volume for markets other than the Chicago Board of Trade, and "revised" daily figures for the latter. The figures for June, 1924, were as follows (as released for publication July 10, 1924):

U. S. DEPARTMENT OF AGRICULTURE, GRAIN FUTURES ADMINISTRATION, BRANCH OFFICE, 717 POSTAL TELEGRAPH BUILDING, CHICAGO, ILL.

*Revised* figures showing the daily volume of trading in grain futures on the Board of Trade of the City of Chicago during the month of June, 1924, together with monthly totals for all of the "contract markets" except the Baltimore Chamber of Commerce, as reported by the Grain Futures Administration of the U. S. Department of Agriculture. (The figures listed represent the sales, or only one side of the transaction, there being an equal number of *purchases*.)

*Volume of trading in grain futures*

[In thousands of bushels, i. e., 000 omitted]

Date, June, 1924	Wheat	Corn	Oats	Rye	Barley	Flax	Total
Sunday.							
2.....	27, 968	8, 524	1, 528	677	-----	-----	38, 697
3.....	21, 850	8, 057	1, 481	733	-----	-----	32, 121
4.....	21, 052	9, 980	3, 463	322	-----	-----	34, 817
5.....	18, 396	7, 784	5, 327	804	-----	-----	32, 311
6.....	19, 302	4, 667	1, 952	490	-----	-----	26, 411
7.....	9, 529	7, 950	2, 027	329	-----	-----	19, 835
Sunday.							
9.....	9, 236	13, 107	1, 622	1, 304	-----	-----	25, 269
10.....	39, 181	20, 065	5, 523	1, 875	-----	-----	66, 644
11.....	45, 130	15, 895	4, 705	3, 350	-----	-----	69, 080
12.....	30, 069	10, 046	1, 927	2, 224	-----	-----	44, 266
13.....	34, 500	11, 932	1, 468	2, 332	-----	-----	50, 232
14.....	22, 641	5, 636	1, 161	1, 181	-----	-----	30, 619
Sunday.							
16.....	44, 552	15, 875	2, 580	2, 982	-----	-----	65, 989
17.....	32, 630	12, 720	2, 060	1, 896	-----	-----	49, 306
18.....	48, 807	32, 950	5, 506	3, 540	-----	-----	90, 803
19.....	51, 471	19, 012	4, 204	1, 918	-----	-----	76, 605
20.....	30, 716	12, 974	1, 755	1, 030	-----	-----	46, 475
21.....	21, 696	10, 331	2, 185	750	-----	-----	34, 962
Sunday.							
23.....	29, 901	18, 366	1, 977	1, 777	-----	-----	52, 021
24.....	26, 729	23, 774	2, 473	1, 034	-----	-----	54, 015
25.....	22, 674	28, 269	6, 712	1, 050	-----	-----	58, 705
26.....	40, 070	21, 851	9, 005	3, 361	-----	-----	84, 287
27.....	37, 123	27, 050	4, 656	7, 330	-----	-----	76, 159
28.....	17, 525	12, 269	2, 917	2, 045	-----	-----	34, 756
Sunday.							
30.....	31, 779	25, 292	5, 947	3, 241	-----	-----	66, 259
Total Chicago Board of Trade.....	734, 527	394, 376	84, 166	47, 575	-----	-----	1, 260, 644
Chicago Open Board.....	26, 229	10, 315	860	-----	-----	-----	37, 404
Minneapolis Chamber of Commerce.....	41, 211	-----	3, 844	13, 417	209	352	59, 033
Kansas City Board of Trade.....	28, 709	16, 555	194	-----	-----	-----	45, 458
Duluth Board of Trade.....	9, 144	-----	-----	14, 026	-----	614	23, 784
St. Louis Merchants' <sup>1</sup> Exchange.....	8, 863	3, 232	-----	-----	579	-----	12, 095
Milwaukee Chamber of Commerce.....	1, 372	1, 842	371	389	96	-----	3, 974
San Francisco Chamber of Commerce.....	-----	-----	-----	-----	579	-----	579
Los Angeles Grain Exchange.....	-----	-----	-----	-----	96	-----	96
Total all markets.....	850, 055	426, 320	89, 435	75, 407	884	966	1, 443, 067

<sup>1</sup> Durum wheat.

During the month of June the volume of trading on the Board of Trade of the city of Chicago exceeded the volume for the month of May to the extent of 130 per cent in wheat, 40 per cent in corn, 124 per cent in oats, 221 per cent in rye, and 97 per cent in all grain futures. The increase for June over May for all futures on the Chicago Open Board was 66 per cent; Minneapolis Chamber of Commerce, 125 per cent; Kansas City Board of Trade, 87 per cent; Duluth Board of Trade, 94 per cent; St. Louis Merchants' Exchange, 105 per cent; Milwaukee Chamber of Commerce, 79 per cent; San Francisco Chamber of Commerce, 161 per cent; Los Angeles Grain Exchange, 1,100 per cent. For all markets combined the increase was 98 per cent.



The foregoing table not only exemplifies a standard feature of the publicity issued by the Grain Futures Administration, but also brings down to June 30, 1924, certain daily data included in the statistical bulletin to which reference has already been made.

During July, 1924, the total volume of trading in grain futures showed a marked increase over June. The total for all markets was 2,172,574,000 bushels, an amount above that for July in 1921, 1922, or 1923. The figures for the Chicago Board of Trade for July, 1924, were as follows: Wheat futures, 1,184,022,000; corn futures, 531,131,000; oats futures, 156,117,000; rye futures, 90,826,000; all grain futures, 1,926,096,000. A larger volume was shown in August, 1924.

Beginning January 3, 1924, the grain exchange supervisor at Chicago began to release every day for publication the volume of trading in grain futures reported for the preceding day on the Board of Trade of the City of Chicago. The first of these releases was as follows:

#### TRANSACTIONS OF JANUARY 2, 1924

The volume of sales for future delivery on the Chicago Board of Trade, as reported by the Grain Futures Administration, for Wednesday, January 2, subject to corrections of minor importance, was as follows:

	Bushels
Wheat.....	13,648,000
Corn.....	6,128,000
Oats.....	601,000
Rye.....	147,000
All grains.....	20,524,000

The "corrections of minor importance" eventually made in the foregoing figures were revisions of 65,000 bushels upward for wheat and 40,000 bushels downward for corn. The necessity for such corrections arises from the fact that the daily reports made by clearing members on any day are subject to some error, which reporting firms are obliged to correct "as soon as possible or with the next succeeding report." The "revisions" are included in the monthly release, of which the one for June, 1924, has already been presented as a sample. Such monthly releases, therefore, should be used by parties who want the most accurate volume figures for statistical purposes and who are in position to wait for the monthly revisions. These appear about the 10th of each month.

Volume figures, by days, for wheat futures for the Chicago Board of Trade, for the period January 1, 1921, to May 31, 1924, have been published in U. S. Department of Agriculture

Statistical Bulletin No. 6. This bulletin also gives by calendar years the volume of trading in all grain futures combined for each of the seven principal markets. The figures given for the period covered provide information with which the monthly and daily releases already described may properly be compared as issued.

Volume figures currently released do not yet give the information "by futures," i. e., with each future listed separately, as May wheat, July wheat. For wheat futures, however, Statistical Bulletin No. 6 gives the volume by futures for the period to which it relates, and this report contains further volume data by futures. The Grain Futures Administration has under consideration the advisability of releasing volume figures monthly, weekly, or daily by futures.

The current volume figures which have been released to date have been given publicity for two principal reasons, first because there has long been an eager curiosity with reference to such figures on the part of critics of the grain-futures exchanges, who have hitherto had to content themselves either with estimates (often exaggerated) or with figures relating to periods long since relegated to history, and, second, in order to serve certain narrower and more specific purposes. Thus, the daily volume figures have been asked for by traders and by students of market movements because they throw light upon the character of the market, as active or inactive. They indicate whether the grain-futures business is prosperous or the reverse. Some traders also use such figures at times to help them determine the trend of the market, on the theory, for instance, that a market which becomes "dull on declines" (or on "rallies") is preparing to change its direction of movement. The figures have also been used by individual grain-futures commission houses in order to determine, each for itself, whether it has been holding its own with reference to other such houses and in relation to the total volume of futures business. A special effect of the publication of these total volume figures has been to give rise to a demand concerning the proportion of the total which represents "scalping" transactions. But the chief purpose hitherto served by the publication of these volume figures has been to help "dispel the mystery" which has always surrounded the exchanges in the public mind and with it some part of the popular suspicion that the volume o



transactions in futures is a forbidden subject, incapable of legitimate consideration or explanation. Some further uses of these figures are indicated and illustrated in another part of this report.

After the total volume of futures trading is known for each grain, for each market, and for all markets combined the next step is to determine (by analysis) into what significant classes such trading falls and (by compilation) how much of it falls into each class. Such analysis and compilation are under way and will be continued. Some preliminary results have been found suitable for publication and have been published. Three of these are discussed in order in the following paragraphs:

(I) For some grains and in some markets, if not for all grains in all markets, more of the trading falls into the class of "pit trading" or "pit scalping" than into any other class. This conclusion is in general accord with the view commonly held in the trade, but it can now be expressed with some precision. Thus, the following statement was officially published in May, 1924: "Of the average daily transactions (in wheat futures, Chicago Board of Trade) for 1923, amounting, as already stated, to about 28,500,000 bushels, fully 14,000,000 bushels, or the average, or not less than 50 per cent, it is fairly estimated represented the operations of 'pit traders' or 'scalpers.'" (Senate Document 110, p. 3.)

This estimate was based in part upon data relating to so-called "scratch trades." "Scratch trades," or "scratch sales," as defined by the regulations of the Treasury Department under the revenue act of 1921, are those in which "the purchase and sale are made at the same exchange, on the same day at the same price and for the account of the same person." That almost all such trades are for the account of "pit traders" or "scalpers" is a matter of common knowledge. Scratch trades in wheat futures during the first four months of 1923 were found by actual count to have amounted to 33.2 per cent of all the trading in wheat futures during that period. For the corresponding periods of 1922 and 1921 the percentages of scratch trades in wheat futures to total trading therein were, respectively, 30.8 per cent and 27.3 per cent. The average for all three periods was 30.3 per cent. For each of the months included in these periods, and for certain other months, the percentages found were as presented in Table 3:

TABLE 3.—*Wheat futures: Chicago Board of Trade, percentage of "scratch trades" to total trading during certain periods*

Calendar month	Percentage of "scratch trades" to total volume of trades		
	1921	1922	1923
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
January.....	25.7	32.7	33.7
February.....	27.5	30.5	34.9
March.....	27.7	30.5	34.6
April.....	27.9	30.1	30.9
Averages.....	27.3	30.8	33.2
October.....		31.5	
November.....		31.9	
December.....		30.8	
Average.....		31.3	

The futures included in Table 3 are the futures which were active in the period studied, i. e., May wheat and July wheat in all four periods, and in addition September wheat in the three 4-month periods, December wheat in the 3-month period, and March wheat in 1921.

The figures presented above were used for the purpose of estimating the total scalping trade during the calendar year 1923 by assuming that virtually all scratch trades are scalping trades, that the percentage of scratch trades to total trades during the whole year 1923 may have been as large as the average of the first four months of the year (33.2 per cent), and that it must have been at least as large as the average for the four sample periods (about 30 per cent), and that "scalpers" or "pit traders" make at least as many "nonscratch" trades as they do "scratch" trades, i. e., that they make a profit or take a loss on at least half of their trades. This last assumption is current in the trade, conforms to the general observation of the Grain Futures Administration, and has been verified by examination of a few "scalpers" accounts. On these assumptions the percentage of scalping to total trading, for wheat futures during 1923, Chicago Board of Trade, was estimated (conservatively) at somewhat less than twice the percentage of "scratch trades" to total trading. In other words, if scratch trading constituted 30 per cent of all transactions in wheat futures during 1923, then "scalping" constituted "not less than 50 per cent" of all such transactions.

The Grain Futures Administrator is engaged on a segregation of scalping trades from total trades for each grain

and for each market and hopes eventually to be able to publish a more precise figure than the one given above. This segregation takes considerable time, for reasons that have been indicated in the discussion of the method by which records are now kept and reports now made to the Grain Futures Administration by "clearing members." Very few "clearing members" clear for "scalpers" only, so that most of the "scalping" trades that are at present reported to the Grain Futures Administration are intermingled with all the other trades.

Precise knowledge with regard to the total amount of "scalping" trade and its percentage to the total of all futures trading is believed by the Grain Futures Administration to be worth knowing, and worth making public, for three principal reasons as follows: (1) Because this information will afford a basis not hitherto available for appraising the economic function which "scalpers" perform; (2) because "scalping" trade affords little revenue to grain futures commission houses, inasmuch as the charge for clearing is but 25 cents per thousand bushels, and "scalpers" ("pit traders") pay such houses no other commission on their trades; and (3) because "scalping trade must be segregated from trade such as does pay commissions (\$1.25 per thousand for members of the exchange and \$2.50 per thousand for nonmembers), in order to help determine a question which is of considerable interest to the general public and to students of the economics of marketing, i. e., the question as to the total cost to the country of carrying on the business of trading in grain futures and the distribution (or "incidence") of this cost as among producers, distributors, and consumers of grain on the one hand and different classes of speculators in grain futures on the other.

One item of such total cost, although not of course the only item, is represented by commissions. A mistake often made in estimating these commissions is that of multiplying the total volume of sales by the full commission, as 8,572,111,000 bushels (wheat futures, Chicago, 1923) times \$2.50 per thousand bushels, on the assumption that the result (e. g., \$21,430,277.50) represents commission charges paid by somebody. Such estimates are often coupled with the assertion that such commission charges are paid by the producers of grain or by the consumers thereof. The information presented above shows that such

statements overestimate commission charges by at least 100 per cent, but does not suffice of course to indicate how large the correct figure actually is, nor to show what elements of the population stand in the end the expense represented by it and in what proportions each element tends to stand a share of it.

(II) A comparatively large percentage of the total volume of futures trading is handled by a comparatively small number of grain-futures commission houses. Thus the following statement has been authorized and published: "Thirty of the 'clearing members' of the Chicago Board of Trade, representing 23 per cent of the 'clearing members' in business at the end of the year, handled during 1923 over 60 per cent of all the transactions in wheat futures that took place during the year on the Chicago Board of Trade." This statement was made on May 3, 1924, and represented the best estimate which could be made at the time. It can now be replaced by figures resulting from completed compilations.

At the end of the year 1923 there were 132 active members of the clearing house of the Board of Trade of the City of Chicago. The 30 "clearing members" referred to above include all the large grain-futures commission houses and a few of the smaller ones. They were not selected on the basis of size, but include all the firms found by a special investigation to have carried any "customers" accounts in wheat futures that fell into a certain class, viz, the "half-million class," including all accounts that were at any time during the year 1923 net "long" or net "short" (all wheat futures combined) as much as 500,000 bushels. There were 150 such accounts.

Compilations have now been completed which show that the 30 firms in question handled 54.9 per cent of the total trading in wheat futures during the year. Fifteen of these firms, comprising about 12 per cent of the "clearing members," handled 36.1 per cent of the trading. These 15 firms include all those which reported accounts in "the half-million class" which were designated by the Grain Futures Administration as being speculative accounts. Thirty-two such accounts were reported by these 15 firms, along with about 16 accounts of similar size and description classified as "hedging" accounts, and a smaller number of unclassified accounts.

(III) Preliminary figures indicate that the trading that takes place for



the accounts of "large" traders, whether "hedgers" or "speculators," probably constitutes a comparatively small percentage of the total trading. No factual basis for a final conclusion on this point exists, because the figures available are for too short a period and are too incomplete in themselves. But 77 accounts in the "half-million" class (wheat futures, 1923, Chicago) constituted 6 per cent of the total trading in wheat futures (on the Chicago Board of Trade) during the year, 3.3 per cent being for 45 "hedging" accounts and 2.7 per cent being for 32 speculative accounts.

These two groups included, among other customers, the majority of the well-known terminal elevator companies and the majority of the well-known speculators, but the trading reported did not include all the trading for either of these groups. The explanation of this incompleteness is that some members of both these groups of "customers" had accounts which were not reported, and which were not required to be reported, either in the regular daily reports or in any of the special reports. These were (1) accounts with "clearing members" which never at any time during the year reached the 500,000 bushel level, and (2) accounts, large or small, with commission houses not belonging to the clearing house. There are reasons why missing items of the character described have not yet been assembled by the Grain Futures Administration, as explained in detail in the discussion of records and reports that appears in an earlier part of this report. Such reasons are expected by the Grain Futures Administration to become of diminishing weight as experience improves the processes of making and handling such reports as are already being made. It is hoped, therefore, that studies under way with regard to the proportion of trading that is for account of large traders, like other preliminary studies, will eventually result in the publication of more complete and satisfactory figures on this point.

Nothing has yet been published with regard to the proportions in which the total trading in grain futures is divided as between "hedging" trades and "speculative" trades. This question is one of whose importance the Grain Futures Administration is aware, and some progress is being made toward an answer to it. The chief requisite for such an answer is more complete and better classified information with regard to the operations

of "ultimate traders," as heretofore explained in the discussion of how records are now kept and how reports are now made. A similar observation applies to a number of other significant classes into which trading in grain futures might be divided.

This completes the discussion of the publicity that has already been given by the Grain Futures Administration to figures concerning the volume of trading in grain futures. Additional volume figures, not hitherto published, are given in later portions of this report. The present discussion will now turn to the second of the principal kinds of information to which publicity has been given, i. e., "open interests."

#### PUBLICITY CONCERNING "OPEN INTERESTS"

The Grain Futures Administration has given publicity to figures concerning "open interests" and "net positions," "long commitments," and "short commitments," all of which terms are explained elsewhere in this report. For reasons there set forth, nothing has been published with regard to the "ultimate" open interest, representing all ultimate traders combined. This point is emphasized in order to guard against misinterpretation of the open-interest figures which have in fact been published. All these relate to "customer's" open interests, as defined elsewhere.

The first information published on this matter by the Grain Futures Administration was released on May 3, 1924, in the report made to the United States Senate to which reference has already been made. The statement there made runs as follows:

The average size of the "customers' open interest" represented by these "clearing members" taken together, as estimated for the year upon the basis of the daily reports rendered during the last half of the year 1923, as hereinbefore explained, amounted to somewhat more than 90,000,000 bushels, counting but one side of each transaction. This figure may be taken to represent either the aggregate of all customers' accounts which were "long" or the aggregate of all customers' accounts which were "short," items which must necessarily be equal, and which include, of course, accounts of every character, including accounts for persons engaged in the cash grain business and making use of the futures market for "hedging" purposes, as well as accounts for speculators.

This statement can now be supplemented and made more precise and its significance explained more fully than was possible in the report made to the Senate.

"Customer's" open interest figures are available as of the end of the month for 6 markets. On the basis of these figures averages have been computed as shown in Table 4.



TABLE 4.—Wheat futures: Average "customers'" open interests (one side only) at month ends for six markets for certain periods

Market	Period ended June 30, 1924	Average "customers'" open interest	Per cent of total
		<i>Bushels</i>	
Chicago.....	12 months...	89,506,000	74.52
Minneapolis..	11 months...	13,989,000	11.65
Kansas City..	do.....	9,874,000	8.22
Duluth.....	do.....	4,828,000	4.02
St. Louis.....	6 months...	1,657,000	1.38
Milwaukee....	do.....	247,000	.21
Total, 6 markets.....		120,101,000	100.00

<sup>1</sup> The "customers'" open interest in wheat futures on the Chicago Board of Trade has been ascertained as of the close of business on every trading day for the period July 9, 1923, when the daily reports began, to June 30, 1924. This period includes 296 of the 301 trading days included in the crop year July 1, 1923 to June 30, 1924. The average open interest computed on this basis was 90,689,000 bushels. This figure, like the others presented in this table, may be taken to represent either the aggregate of all "customers'" accounts which were "long" or the aggregate of all "customers'" accounts which were "short," items which must necessarily be equal.

Table 4 indicates that the average "customers'" open interest in wheat futures in all the principal wheat futures markets combined during the crop year July 1, 1923 to June 30, 1924, and counting one side only of each open contract, was approximately 120,000,000 bushels.

These open-interest figures, as already explained, represent the "customers'" open interest, using the term "customer" as meaning an individual, firm, or corporation whose account is carried on the books of a "clearing member." Inasmuch as many of such "customers" are commission houses, having customers of their own, as explained elsewhere, the figures here given fall short of the "true" open interests for all "ultimate" customers, and do so by an amount which it is as yet impossible to determine. The true open interest, however, was certainly more than 120,000,000, and probably much more.

This 120,000,000 includes of course "spreads between months" in the same market and "spreads between markets," two unknown items, for both of which allowance would need to be made before using the figure for certain purposes.

The need for information regarding the two items here mentioned, together with other items still lacking, can be

illustrated by undertaking to determine on the basis of available data what proportion of the open contracts in wheat futures represents (on one side or the other) "hedging transactions" and what proportion represents (on both sides) "speculative transactions." Let 120,000,000 bushels represent the average "customers'" open interest, either "long" or "short," as defined. No comparable figures based on actual records of "hedge sales" or "hedge purchases" are available. Estimates of these items are very unsatisfactory. Thus it might be supposed (1) that all (or almost all) the wheat in the "visible supply" for the crop year 1923-24 was "hedged" in the futures markets and (2) that all (or almost all) the wheat "hedged" in the futures markets during the period was in the "visible supply." The first of these two assumptions has some validity, but the second probably falls considerably short of the truth because it fails to allow for certain items presumably "hedged" but not included in the "visible supply" figures. Thus the average "visible supply" of wheat as computed from the week-end figures given by Bradstreet's amounted to approximately 64,000,000 bushels (of which approximately 48,000,000 bushels were located in the cities in which the six futures markets included in the foregoing table are situated). But this 64,000,000 does not include wheat "in transit," by rail or by water, much of which was undoubtedly "hedged," or wheat in country elevators, some of which was certainly "hedged." For the purpose in hand, therefore, the 64,000,000 figure is certainly too small, and by an unknown amount.

Furthermore, the open-interest figure (120,000,000) is also too small. It needs (1) correction by addition of an amount representing the missing items for ultimate traders who are customers of "outside" commission houses, and (2) correction by subtraction of the two kinds of "spreads" already mentioned. The amount of these "spreads" is as yet unknown, but it is believed to be much less than the missing items for ultimate traders.

The attempt, therefore, to determine by estimate the distribution of the open contracts in wheat futures, either on the "long" side or on the "short" side, as between "hedge transactions" and "speculative transactions" may result in the conclusion that more than one-quarter and possibly more than one-half of the average outstanding commitments in wheat

futures during 1923-24 represented "hedged," but the principal result of the analysis, and the purpose for which it has been presented, is to show that conjecture must be replaced by actual knowledge before anyone, whether friendly or unfriendly to the practice of trading in grain futures, can appraise the economic functions of the practice.

The same observation applies to any conclusion regarding the relative importance of other components into which the ultimate open interest may be analyzed. Facts already published by the Grain Futures Administration with regard to some of these components, or now ready for publication, will illustrate this proposition.

Preceding references to "scalping," for instance, have suggested that "scalpers," taken as a group, do not usually commit themselves very heavily on either side of the market for any considerable length of time, e. g., even for as long as "over night." Thus the Grain Futures Administration has stated (Senate Document No. 110) that most of such traders "usually go home every night in a position that is 'even,' or almost 'even'; that is, neither 'long' nor 'short.'" This amounts to saying that the percentage of the open interests representing "scalpers" is almost negligible, e. g., that they "carried" on the average but a very small part of the 120,000,000 bushels (wheat futures) said above to be outstanding on the average in all markets and a much smaller part of the (presumably) much larger figure representing the ultimate open interest. This view is current in the trade and conforms to the general observation of the Grain Futures Administration, but as long as the share of "scalpers" in the open interest has not been precisely measured, their function in the market must continue to suffer in the public mind either from under valuation or from overvaluation. The segregation of "scalping" operations, therefore, upon which the Grain Futures Administration is engaged is expected, when finished and published, to help gain for the function of "scalpers" the consideration which it deserves and to give additional meaning to such open-interest figures as are released for publication from time to time.

In order to show the nature of the work involved in analyzing and segregating "spreading" operations, the following composite showing is presented for four large accounts in wheat futures involving some "spreads" be-

tween Chicago and Winnipeg. For these four accounts figures relating to operations in futures in both markets happen to be available for the calendar year 1923.

The combined net position of these four accounts, allowing for commitments in both markets, was sometimes "net long," sometimes "net short," and sometimes "even." It was "long" on but two occasions, first on March 21-24, by about 250,000 bushels, and second for about three weeks from November 30 to December 22, by an amount varying from 15,000 bushels to 855,000 bushels. On the first of these occasions one of the four accounts was net "long" and two were net "short," while the fourth was "even" and was therefore the only true and complete "spread" among the four at the time.

The combined net position of the four accounts was "short" from January 1 to March 21, from March 24 to October 3, and from October 19 to November 27. The maximum net "short" interest of the four accounts at any time was 1,220,000 bushels, August 16-23.

The combined net position of the four accounts was "even" from October 4 to 18, on November 28 and 29, and from December 23 to 31. During these eight days in December, however, all four of these accounts were "even" in the sense that they were not in the market.

No one of these four accounts ever showed at any time during the year a net position, allowing for commitments in both markets, of more than 1,500,000 bushels "short" or more than 1,000,000 bushels "long."

The largest open interest in the Chicago market shown by any one of these four accounts was about 2,250,000 bushels "short" in the month of January, offset to the extent of somewhat less than 1,000,000 bushels "long" in the Winnipeg market, and the largest open interest in the Winnipeg market shown by any one of these accounts was somewhat more than 900,000 bushels "long," an amount offset (after standing "long" one day) by a "short" interest in the Chicago market of substantially equivalent amount.

How far the four accounts described and analyzed are to be considered representative of the class of accounts to which they belong can not be precisely indicated, because data relating to but 9 more similar accounts are at present available; incomplete in every case. Of these 9 accounts, however,



but 1 is properly to be considered as larger than any of the 4 analyzed. The Chicago end of the futures transactions reported for this 1 account was never much above 2,500,000 bushels "short," against which commitments in other markets or in cash grain are not available.

The Grain Futures Administration has also stated (Senate Document No. 110) that 30 "clearing members" of the Chicago Board of Trade represented during 1923 on the average more than 75 per cent of the "customers'" open interests in wheat futures. This statement embodied the best estimate that could be made at the time (May 3, 1924). Since then compilations have been finished for the beginning of each of the last 6 months of 1923. It is accordingly now possible to state that these 30 firms represented, during that period, on the average, 89.5 per cent of the average outstanding "customers'" open interest during the 6-months period. For 15 of these firms the corresponding figure was 59.8 per cent.

The work of classifying traders in grain futures into significant groups, such as "hedgers" and "speculators," and ascertaining the relations which their respective commitments ("open interests") bear to one another, is being continuously carried forward by the Grain Futures Administration. Preliminary results, some of which have already been published in somewhat different form, are indicated in the summary, Table 5, which relates to 132 accounts in wheat futures, all belonging to the "half million" class.

Table 5 shows that on both of the selected dates the "long" commitments for the (limited) "outside commission

house" group exceeded the "long" commitments for both the other (limited) groups by a wide margin and that on both dates the "short" commitments for the (limited) "hedging" group exceeded the "short" commitments of the other two (limited) groups by a wide margin. The highest percentage of the total "customers'" open interest represented by any group was 38.70 per cent for the "hedging" group on the "short" side at the end of September. On both of these dates and on both sides of the market the percentage of the total "customers'" open interest represented by the (limited) "speculative" group was less than 9 per cent; at the end of the year it was less than 2 per cent on the "long" side and less than 5 per cent on the "short" side.

The tables do not show, however, and there are as yet no available figures which do show, what percentages of the open interests are held, respectively, by *all* hedgers on the one hand and *all* speculators on the other, to say nothing of the different classes of hedgers and of speculators.

### MARKET INFORMATION

The dissemination among traders of accurate and comprehensive information concerning all conditions which affect or tend to affect the market price of grain is implicitly recognized by the grain futures act to be a prime requisite for the efficient working of the grain-futures markets. The collection and distribution of such information is one of the notable activities of most boards of trade and of a variety of other agencies, both private and governmental. Not all the market information that is

TABLE 5.—Wheat futures, Chicago Board of Trade, distribution of market commitments among certain groups of accounts on September 29, 1923, and December 31, 1923

[Market commitments in thousands of bushels, i. e., 000 omitted]

Group	Number of accounts	September 29, 1923				December 31, 1923			
		Long commitments		Short commitments		Long commitments		Short commitments	
		Quantity 63, 747	Per cent 100. 00	Quantity 63, 747	Per cent 100. 00	Quantity 77, 818	Per cent 100. 00	Quantity 77, 818	Per cent 100. 00
All "customers".....									
"Outside commission house" group.....	55	13, 293	20. 86	2, 238	3. 52	22, 179	28. 48	3, 388	4. 35
"Hedging" group.....	45	4, 970	7. 80	24, 675	38. 70	820	1. 05	29, 054	37. 33
"Speculative" group.....	32	1, 480	2. 32	5, 650	8. 86	1, 460	1. 88	3, 685	4. 74
Three groups combined.....	132	19, 743	30. 97	32, 563	51. 08	24, 450	31. 42	36, 127	46. 42



in circulation, however, and influential in guiding the policies of traders in futures, is of this character; yet regardless of this fact such information may nevertheless influence market prices for a longer or shorter time. One purpose of the grain futures act, therefore, is to eradicate the practice of disseminating false, misleading, and inaccurate information.

Means provided to accomplish this end include the adoption by boards of trade of rules forbidding the practice, binding upon their own members, and which have been quoted elsewhere in this report; but in addition to this the act forbids such dissemination, knowingly or carelessly, by mail or in certain other ways, by any person, whether he be a member of a board of trade or not. The penalties prescribed include both fine and imprisonment.

The Government regulations, in support of the provisions of the act which relate to the dissemination of market information and for other purposes, include the following requirements (regulation 6):

Every member of a contract market shall furnish, or cause to be furnished or exhibited, to the governing board of such contract market when requested by it, and to the officer in charge of the Grain Futures Administration or his representative when requested by him, a true copy of any report, circular, letter, or telegram published or given general circulation by such member concerning crop or market information or conditions that affect or tend to affect the price of commodities, and the true source or authority of such member for the information therein contained.

The effect of the foregoing regulation is to put the authority of the Government behind proper steps which the governing boards of contract markets may take toward improving the quality of market information disseminated by members. It also serves to put both governing boards and members on notice that the Grain Futures Administration is aware of its own responsibility in the matter and disposed to check the accuracy and authenticity of published statements. But an equally important purpose of the regulation is to put the Grain Futures Administration in position to collect, study, analyze, and file material which throws light upon the nature and meaning of market movements. Such material as is circulated by commission houses very commonly contains suggestive forecasts regarding impending movements, suggestive explanations of current movements, and penetrating observations on movements of the past. Inquiries frequently arise concerning price movements which have passed or are passing into history, and a full understanding of such move-

ments can seldom be arrived at and presented to inquirers without studious reconstruction of the market situation as it was at the time, a difficult task even when the most ample records have been preserved concerning the information which was at the time available and the various appraisals given to it at the time by alert observers of the market.

Early in the crop year 1923-24 arrangements were made by which the Grain Futures Administration, in particular cases, might enlist the assistance of other bureaus of the Department of Agriculture and of other Government departments in checking the accuracy of published statements relating to "conditions that affect or tend to affect the price of grain." Among the agencies to which the Grain Futures Administration has arranged to resort for this purpose are: (1) the Divisions of Information, Crop and Live Stock Estimates, Grain Marketing, and Foreign Crops and Markets, of the Bureau of Agricultural Economics; (2) Weather Bureau; (3) Bureau of Plant Industry; (4) Bureau of Entomology; (5) Bureau of Chemistry; (6) the consular service of the Department of State; (7) the Bureau of Foreign and Domestic Commerce of the Department of Commerce; and (8) various State officials.

The practice of the Grain Futures Administration has been to follow up statements that seemed to be exaggerated, incorrect, or unconfirmed. The cooperation of members, commercial news services, and newspapers has been enlisted. The collection, analysis, and filing of "flashes" disseminated over private wires has been started.

## PUTS AND CALLS

Section 3 of the future trading act of 1921 imposes a tax of 20 cents per bushel on privileges or options known to the trade as "privileges," "bids," "offers," "puts and calls," "indemnities," and "ups and downs." In the case holding unconstitutional other sections of the future trading act the Supreme Court of the United States excepted section 3, holding that: "This is the imposition of an excise tax upon certain transactions of a unilateral character in grain markets which approximate gambling or offer full opportunity for it. \* \* \* Such a tax without more would seem to be within the congressional power. \* \* \* But these are questions which are not before us and upon which we wish to express no definite opinion."

Recently a suit was brought in the United States District Court at Kansas City (*Trusler v. Crooks*, collector of internal revenue, et al.) to test the constitutional validity of this tax and was decided in favor of the tax. From this decision appeal has been taken to the Supreme Court of the United States, where it is now pending.

Transactions of the kind known most generally as "puts and calls" are also referred to as "bids and offers" and "ups and downs." They are also called "privileges," or "indemnities." In the following statement the terms "puts" will be used to cover "puts," "bids," and "downs," and the term "calls" to cover "calls," "offers," and "ups." Unless otherwise specified all references are to the Chicago market.

"Puts" and "calls" are "options" in the strict sense of the term. They differ from "futures" in that they give to the buyer of the "puts" or "calls" the right of exercising the option to sell or to buy a "future" at a definite specified price within a definite period of time. For example, the buyer of the "call" has the privilege of demanding the "future" from the seller of the "call" at the price of the "call," which is always *above* the close of the market on the day the "call" is purchased. Likewise, the buyer of the "put" has the privilege of "putting"; that is, of compelling the seller of the "put" to buy the "future" from him at the price of the "put," which is always *below* the close of the market on the day the "put" is purchased.

A "call" is a price above the close of the market at which the seller of the "call" agrees to sell the "future" to the buyer of the "call" upon demand of the buyer or when "called," thus protecting the buyer of the "call" against further advance if "short." In brief, a "call" is the privilege to buy "futures" at a certain price within a specified time. The "call" is a protection for the person "short," either "cash" or "futures." The "call" is based on the close of the market on the day made and is good until the close of the market the following day if a daily "call." "Calls" may be good for such period as indicated, which may be one week, two weeks, or one month, etc.

A "put" is a price under the close of the market at which the seller of the "put" agrees to take the future from the buyer of the "put" upon demand of the buyer of the "put" or when "put," thus protecting the buyer of the "put" against further decline if "long," thereby limiting his loss. In

brief, a "put" is the privilege to sell "futures" at a certain price within a specified time. The "put" is a protection for the person "long." As in the case of "calls," a "put" is based on the close of the market on the day made and is good until the close of the market the following day. These are known as daily "puts."

The statement that the price for "puts" has always been below the market and that for "calls" always above the market is subject to a slight qualification. Under certain exceptional circumstances both prices may be either above or below the market. The price for "puts" has even been known to be above the price for "calls."

Prior to 1913 the rules and regulations of the Board of Trade of the City of Chicago were silent as to trading in puts and calls, and such trading was generally done outside the exchange hall. To a considerable extent this class of trading was on the basis of rules generally understood rather than officially recorded. However, after the amendment of section 130 of the Illinois Criminal Code in 1913, privileges were officially covered in the "rules and regulations" under "deferred acceptances."<sup>1</sup> Following that date, the trading in puts and calls was officially recognized by the Chicago Board of Trade. The trading returned from outside the exchange hall and was done

<sup>1</sup> RULE XXII, SEC. 19. All offers made subject to deferred acceptance between clearing-house members shall be confirmed by memoranda through the clearing house in the same manner and under the same regulations and requirements as are provided for contracts of purchase and sale in and by the other sections of this rule.

SEC. 20. All offers made subject to deferred acceptance provided for under this rule shall be in the following forms:

#### OFFER MADE SUBJECT TO DEFERRED ACCEPTANCE

CHICAGO, ILL., — day of —, 19—.

I will sell — bushels of contract grade of — at — per bushel for delivery during —, 19—, same to be delivered in store in regular warehouses under the rules of the Board of Trade of the City of Chicago.

This offer is subject to acceptance by you until the closing hour for regular trading on —, 19—. (Signature) —.

#### ACKNOWLEDGMENT OF OFFER MADE SUBJECT TO DEFERRED ACCEPTANCE

CHICAGO, ILL., — day of —, 19—.

I have your offer to sell — bushels of contract grade of — at — per bushel for delivery during —, 19—, same to be delivered in store in regular warehouses under the rules of the Board of Trade of the City of Chicago, and subject to my acceptance until the closing hour for regular trading on —, 19—.

Sections 19 and 20 of Rule XXII were repealed in 1921.



mostly in the pit for a period of one-half hour, beginning 15 minutes after the close of the regular session. The transactions were recorded and handled through the clearing house and were thus given a far more respectable position than they originally held.

On April 12, 1921, the board of directors of the Chicago Board of Trade unanimously adopted a report and recommendations of the president of the board stating that it was their conviction that deferred-acceptance contracts, better known as indemnity transactions, should be abolished and that it was their firm purpose to prevail upon their membership to amend their rules to preclude all transactions in such contracts and at the same time to induce other exchanges to follow the same course.

In this connection it will be of interest to note the position taken by the Winnipeg Grain Exchange on the trading in puts and calls. Their rule covering this point reads as follows: "This exchange does not in any manner whatever recognize the form of trading commonly known as 'puts' and 'calls.'"

Similarly puts and calls are traded in on the Liverpool Exchange, but without sanction of the exchange.

In the early days of trading in puts and calls on the Chicago Board of Trade there was no commission charge for executing orders for puts and calls, the commission houses taking their profits from the trades in "futures" growing out of privilege trading. Subsequently a commission was generally charged for this class of transactions, as follows:

Puts or calls good for one day:  
 25 cents per 5,000 bushels to nonmembers.  
 15 cents per 5,000 bushels to members.  
 Puts or calls good for one week or longer:  
 \$1.25 per 5,000 bushels to nonmembers.  
 .75 per 5,000 bushels to members.

Trades in puts and calls were usually made on a daily basis, i. e., good until the close of the market on the next following business day. There was, however, considerable trading in puts and calls good for one week, two weeks, and occasionally for one month. They may be for any period. The longer the period of time the greater the price below or above the market. Daily puts and calls were generally 1 cent to 2 cents below or above the close. This, too, varied with the general fluctuations in the market.

Transactions in puts and calls were made in units of 1,000 bushels and up, the purchase price in either case being \$1 per thousand, plus the commission if handled through a commission house.

No figures are available on the volume of trading in puts. The volume of calls sold on the Chicago Board of Trade during a part of the year 1921 is given in Table 6. The figures cover the period immediately prior to the time when trading in privileges was discontinued under the future trading act of 1921.

TABLE 6.—"Calls" sold on the Chicago Board of Trade, by grains, during the 8-months period February 1 to September 30, 1921.

Kind of grain	"Calls" sold
	<i>Bushels</i>
Wheat.....	724,712,000
Corn.....	545,325,000
Oats.....	215,426,000
Rye.....	1,675,000
All grains.....	1,487,138,000

No figures are available to show how this trading was distributed as between large traders and small traders, between persons engaged in the cash grain business and persons not so engaged, etc.

## VOLUME OF TRADING IN GRAIN FUTURES

### RELATIVE IMPORTANCE OF DIFFERENT CONTRACT MARKETS

The relative importance of seven contract markets, as measured by the volume of trading which takes place in them, is exhibited in the accompanying tables. They show that the Chicago market is most important in respect to all grain futures combined, and in respect to wheat futures, corn futures, oats futures, and rye futures, while Minneapolis is the most important of the seven markets in respect to barley futures and Duluth in respect to flax futures and durum futures. Accompanying charts (figs. 4 and 5) show what the trading has been from month to month, for all grain futures combined and for wheat futures alone, both for the seven markets and for the Chicago Board of Trade.



TABLE 7.—Grain futures: Volume of trading in each of seven grain futures markets of the United States, by calendar years, for the period 1921 to 1923<sup>1</sup>

Market	Volume of trading in grain futures, in thousands of bushels, i. e., 000 omitted							
	1921		1922		1923		3 years	
	Volume	Per cent of total	Volume	Per cent of total	Volume	Per cent of total	* Volume	Per cent of total
Chicago Board of Trade	20,954,516	88.16	17,492,935	88.14	13,930,551	86.29	52,378,002	87.65
Chicago Open Board of Trade	505,958	2.13	463,964	2.34	445,137	2.76	1,415,059	2.37
Minneapolis Chamber of Commerce	1,087,194	4.57	752,384	3.79	754,870	4.67	2,594,448	4.34
Kansas City Board of Trade	703,480	2.96	570,214	2.87	525,649	3.26	1,799,343	3.01
Duluth Board of Trade	220,344	.93	314,506	1.59	295,224	1.83	830,074	1.39
St. Louis Merchants' Exchange	250,868	1.06	189,143	.95	137,964	.85	577,975	.97
Milwaukee Chamber of Commerce	45,090	.19	63,762	.32	54,272	.34	163,124	.27
Total	23,767,450	100.00	19,846,908	100.00	16,143,667	100.00	59,758,025	100.00

<sup>1</sup> As indicated on page 19 of this report, the volume of trading in grain futures increased toward the middle of the year 1924, a period omitted from this table, to such an extent that in July, 1924, it was materially in excess of the trading in July during any of the preceding three years.

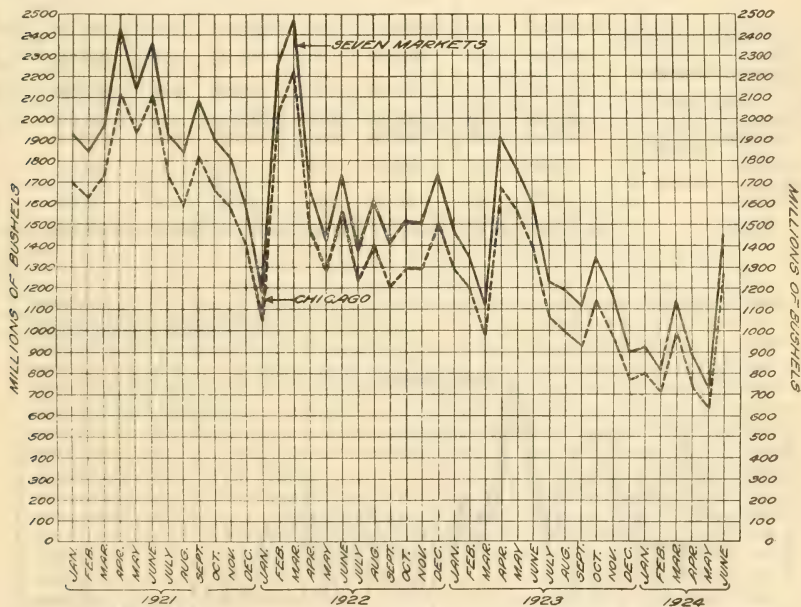


FIG. 4.—Monthly volume of trading in grain futures in seven markets and on the Chicago Board of Trade, January, 1921, to June, 1924. (Based on Tables 36 and 37.)

The volume of trading in grain futures exhibited in Table 7 and by Figure 4 includes the futures for all the different grains—wheat, corn, oats, rye, barley, and flax. The seven exchanges included handle altogether more than 99 per cent of all the trading in grain futures which takes place in

the United States. Three exchanges are omitted from the table, namely, those located at San Francisco, Los Angeles, and Baltimore, because volume figures for all three years comparable with those presented for the other markets are not yet available. Much of the trading in these three markets

is not trading in "futures" in the sense commonly understood by the grain trade in other markets, but is trading in grain for deferred delivery. None of these three markets, furthermore, is a "continuous" market, because in all of them periods of several days frequently elapse on which there is no trading, and because such trading as does take place is only "on call." The combined trading in grain futures on the two Pacific coast markets during the month of June, 1924, amounted to 675,000 bushels, all barley, of which 579,000 took place at San Francisco,

and 96,000 at Los Angeles. There was no trading at Baltimore between February 1 and June 30.

These three markets are accordingly omitted from Table 7, and are not included in any of the other statistical tables presented in this report.

The relative importance of each of the different futures markets in respect to each of the grains is indicated by Tables 8 to 13. The accompanying chart (fig. 5) shows the monthly volume of trading in wheat futures during the three and one-half years ended June 30, 1924.

TABLE 8.—Wheat futures: Volume of trading in each of seven grain futures markets of the United States, by calendar years, for the period 1921 to 1923

Market	Volume of trading in wheat futures, in thousands of bushels, i. e., 000 omitted							
	1921		1922		1923		3 years	
	Volume	Per cent of total	Volume	Per cent of total	Volume	Per cent of total	Volume	Per cent of total
Chicago Board of Trade.....	12, 273, 650	86. 83	11, 072, 545	87. 18	8, 572, 111	85. 08	31, 918, 306	86. 45
Chicago Open Board of Trade.....	237, 780	1. 68	366, 559	2. 89	328, 452	3. 26	932, 791	2. 53
Minneapolis Chamber of Commerce.....	788, 446	5. 58	503, 956	3. 97	544, 600	5. 40	1, 837, 002	4. 97
Kansas City Board of Trade.....	527, 560	3. 73	393, 181	3. 10	347, 169	3. 44	1, 267, 910	3. 43
Duluth Board of Trade.....	175, 052	1. 24	198, 264	1. 56	184, 400	1. 83	557, 716	1. 51
St. Louis Merchants' Exchange.....	126, 857	. 90	139, 471	1. 10	83, 187	. 83	349, 515	. 95
Milwaukee Chamber of Commerce.....	10, 213	. 07	25, 791	. 20	22, 365	. 22	58, 369	. 16
Total.....	14, 139, 558	100. 00	12, 699, 767	100. 00	10, 082, 284	100. 00	36, 921, 609	100. 00

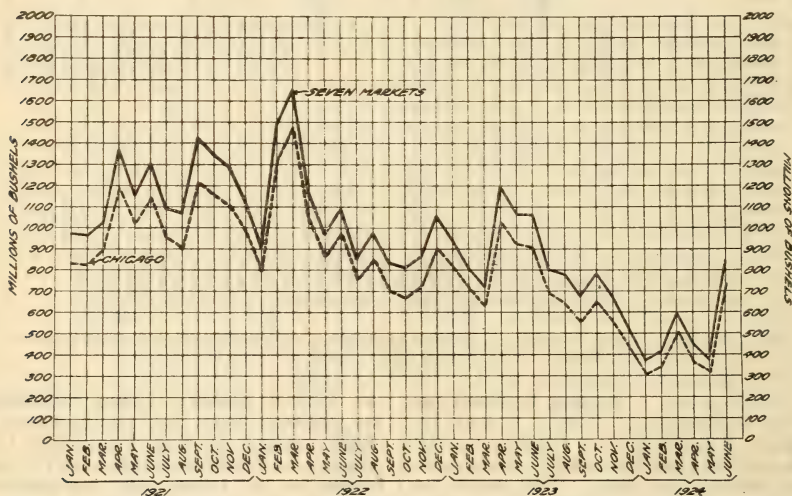


FIG. 5.—Monthly volume of trading in wheat futures in seven markets and on the Chicago Board of Trade, January, 1921, to June, 1924. (Based on Table 37.)

Table 8 shows that the Chicago Board of Trade handles more than five times as much business in wheat futures as all the other wheat futures markets combined, and that the next two markets in order of importance are Minneapolis and Kansas City. Several of these markets have an importance in the grain trade out of proportion to the volume of wheat futures which they handle. This is because the class or grade of wheat upon which the futures contract is based is not the same in all markets. Thus the standard wheat-

futures contract at Kansas City calls for delivery of winter wheat, the Minneapolis contract for the delivery of spring wheat, and for almost all the trading in wheat futures at Duluth the standard contract relates to durum. During the calendar year, 1923, 98 per cent of the trading in wheat futures at Duluth related to durum, and Duluth is the only wheat futures market trading in durum futures. Classified information concerning deliverable grades, both for wheat and for other grains, is given\* on page 47 of this report.

TABLE 9.—*Corn futures: Volume of trading in each of seven grain futures markets of the United States, by calendar years, for the period 1921 to 1923*

Market	Volume of trading in corn futures, in thousands of bushels, i. e., 000 omitted							
	1921		1922		1923		3 years	
	Volume	Per cent of total	Volume	Per cent of total	Volume	Per cent of total	Volume	Per cent of total
Chicago Board of Trade	5,830,304	91.78	4,506,683	93.16	4,286,837	92.21	14,623,924	92.33
Chicago Open Board of Trade	212,181	3.34	84,742	1.75	111,838	2.41	408,761	2.58
Minneapolis Chamber of Commerce	(1)	-----	7,941	.17	473	.01	8,414	.05
Kansas City Board of Trade	168,538	2.65	168,447	3.48	176,105	3.79	513,090	3.24
Duluth Board of Trade	(1)	-----	(1)	-----	(1)	-----	(1)	-----
St. Louis Merchants' Exchange	122,301	1.93	46,592	.96	54,152	1.16	223,045	1.41
Milwaukee Chamber of Commerce	19,060	.30	23,201	.48	19,650	.42	61,911	.39
Total	6,352,384	100.00	4,837,606	100.00	4,649,055	100.00	15,839,045	100.00

\* No trading in corn futures.

Table 9 shows that more than nine-tenths of the trading in corn futures takes place on the Board of Trade of the City of Chicago. For corn futures, therefore, the preponderance of Chicago over the other futures markets is even

greater than it is for wheat futures. Appreciable amounts of trading in corn futures also take place at Kansas City and St. Louis. There is some trading in corn futures at Baltimore.

TABLE 10.—*Oats futures: Volume of trading in each of seven grain futures markets of the United States, by calendar years, for the period 1921 to 1923*

Market	Volume of trading in oats futures, in thousands of bushels, i. e., 000 omitted							
	1921		1922		1923		3 years	
	Volume	Per cent of total	Volume	Per cent of total	Volume	Per cent of total	Volume	Per cent of total
Chicago Board of Trade	2,653,688	89.29	1,559,923	88.10	788,303	87.82	5,001,914	88.69
Chicago Open Board of Trade	55,997	1.88	12,659	.72	4,744	.53	73,400	1.30
Minneapolis Chamber of Commerce	237,679	8.00	173,962	9.83	92,289	10.28	503,930	8.93
Kansas City Board of Trade	7,382	.25	8,586	.48	2,375	.27	18,343	.32
Duluth Board of Trade	(1)	-----	(1)	-----	(1)	-----	(1)	-----
St. Louis Merchants' Exchange	1,710	.06	3,080	.17	625	.07	5,415	.10
Milwaukee Chamber of Commerce	15,353	.52	12,339	.70	9,270	1.03	36,962	.66
Total	2,971,809	100.00	1,770,549	100.00	897,606	100.00	5,639,964	100.00

\* No trading in oats futures.



Nearly nine-tenths of the trading in oats futures takes place on the Chicago Board of Trade. The relative importance of Minneapolis is greater in respect to oats futures than in respect to wheat futures.

TABLE 11.—*Rye futures: Volume of trading in each of the seven principal grain futures markets of the United States, by calendar years, for the period 1921 to 1923*

Market	Volume of trading in rye futures, in thousands of bushels, i. e., 000 omitted							
	1921		1922		1923		3 years	
	Volume	Per cent of total	Volume	Per cent of total	Volume	Per cent of total	Volume	Per cent of total
Chicago Board of Trade..	192, 464	84. 49	353, 230	71. 70	283, 035	61. 02	828, 729	69. 98
Chicago Open Board of Trade.....	( <sup>1</sup> )	-----	4	-----	103	. 02	107	. 01
Minneapolis Chamber of Commerce.....	18, 640	8. 18	40, 484	8. 22	93, 448	20. 15	152, 572	12. 88
Kansas City Board of Trade.....	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----
Duluth Board of Trade..	16, 245	7. 13	96, 495	19. 59	84, 255	18. 17	196, 995	16. 63
St. Louis Merchants' Exchange.....	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----
Milwaukee Chamber of Commerce.....	455	. 20	2, 420	. 49	2, 987	. 64	5, 862	. 50
Total.....	227, 804	100. 00	492, 633	100. 00	463, 828	100. 00	1, 184, 265	100. 00

<sup>1</sup> No trading in rye futures.

Table 11 shows that in respect to rye futures both Minneapolis and Duluth are important markets, although Chicago handles considerably more than half of all the business.

TABLE 12.—*Barley futures: Volume of trading in each of seven grain futures markets of the United States, by calendar years, for the period 1921 to 1923*

Market	Volume of trading in barley futures, in thousands of bushels, i. e., 000 omitted							
	1921		1922		1923		3 years	
	Volume	Per cent of total	Volume	Per cent of total	Volume	Per cent of total	Volume	Per cent of total
Chicago Board of Trade..	4, 410	15. 09	554	3. 18	265	2. 2	5, 229	8. 91
Chicago Open Board of Trade.....	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----
Minneapolis Chamber of Commerce.....	24, 810	84. 88	16, 839	96. 76	11, 781	97. 8	53, 430	91. 06
Kansas City Board of Trade.....	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----
Duluth Board of Trade..	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----
St. Louis Merchants' Exchange.....	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----	( <sup>1</sup> )	-----
Milwaukee Chamber of Commerce.....	9	. 03	11	. 6	( <sup>1</sup> )	-----	20	. 03
Total.....	29, 229	100. 00	17, 404	100. 00	12, 046	100. 00	58, 679	100. 00

<sup>1</sup> No trading in barley futures.

Only three of the seven principal markets trade in barley futures, for which Minneapolis is far the most important market. The trading in barley futures at Chicago has in fact dwindled to almost nothing. There is some trading in barley futures at both San Francisco and Los Angeles.

TABLE 13.—*Flax futures: Volume of trading in each of seven grain futures markets of the United States, by calendar years, for the period 1921 to 1923*

Market	Volume of trading in flax futures, in thousands of bushels, i. e., 000 omitted							
	1921		1922		1923		3 years	
	Volume	Per cent of total	Volume	Per cent of total	Volume	Per cent of total	Volume	Per cent of total
Chicago Board of Trade	(1)	-----	(1)	-----	(1)	-----	(1)	-----
Chicago Open Board of Trade	(1)	-----	(1)	-----	(1)	-----	(1)	-----
Minneapolis Chamber of Commerce	17, 619	37. 76	9, 202	31. 79	12, 279	31. 61	39, 100	34. 16
Kansas City Board of Trade	(1)	-----	(1)	-----	(1)	-----	(1)	-----
Duluth Board of Trade	29, 047	62. 24	19, 747	68. 21	26, 569	68. 39	75, 363	65. 84
St. Louis Merchants' Exchange	(1)	-----	(1)	-----	(1)	-----	(1)	-----
Milwaukee Chamber of Commerce	(1)	-----	(1)	-----	(1)	-----	(1)	-----
Total.....	46, 666	100.00	28, 949	100.00	38, 848	100.00	114, 463	100. 00

<sup>1</sup> No trading in flax futures.

Only two markets trade in flax futures, Minneapolis and Duluth. Duluth handles about twice the volume of flax-futures trading that is handled at Minneapolis.

#### RELATIVE IMPORTANCE OF DIFFERENT FUTURES

Figures with regard to the volume of trading in grain futures, each future considered by itself, serve to make evident the relative importance of the different futures.

A comprehensive table (Table 38) given elsewhere in this report shows for each of the principal futures expiring between July 1, 1921, and June

30, 1924, on the Chicago Board of Trade, the total amount of trading during the "life" of the future. This includes for wheat, corn, oats, and rye, three Mays, three Julys, three Septembers, and three Decembers, or 12 different futures in all. A small amount of trading in other futures also took place. For barley only 10 futures are included because there was no trading in one of the Julys and one of the Decembers. The data permits the construction of the following summary table (Table 14) which exhibits on an average basis for each grain, the distribution of trading as among the different futures.

TABLE 14.—*Grain futures: Distribution of trading among the principal futures for each of the principal grains, Chicago Board of Trade, for futures expiring between July 1, 1921, and June 30, 1924*

Grain	Per cent of trading in each future to trading in all futures					
	May future	July future	September future	December future	Other futures	Total
Wheat futures.....	40. 15	25. 09	15. 06	19. 68	0. 025	100
Corn futures.....	37. 26	23. 32	18. 40	20. 96	. 06	100
Oats futures.....	34. 76	19. 26	24. 37	21. 55	. 06	100
Rye futures.....	43. 48	18. 34	17. 44	20. 67	. 07	100
Barley futures.....	13. 50	13. 07	29. 26	44. 17	. 00	100

Table 14 shows that at Chicago the May future, in a general way, is easily the most important of all the futures for wheat, for corn, for oats, and for rye, but not for barley, in which the December future has been most important. The differences among the other futures are not large, but the July future appears to be second in importance for all grains except oats. For oats the July future is the least important of the four principal futures, while September oats is second in importance. For all grains a relatively insignificant proportion of the trading takes place in other futures, i. e.,

i. e., for from five to seven months, against one to three months for July wheat, two to four months for December wheat, and one month (July) for September wheat. The data on which this statement is based appear in Tables 39 and 44, printed elsewhere in this report. The volume of trading in each of the principal wheat futures from week to week is also exhibited by the accompanying chart (fig. 6).

The dates on which each of the principal futures became dominant, in the sense already defined, during the last three years at the Chicago Board of Trade, as shown by the reports made

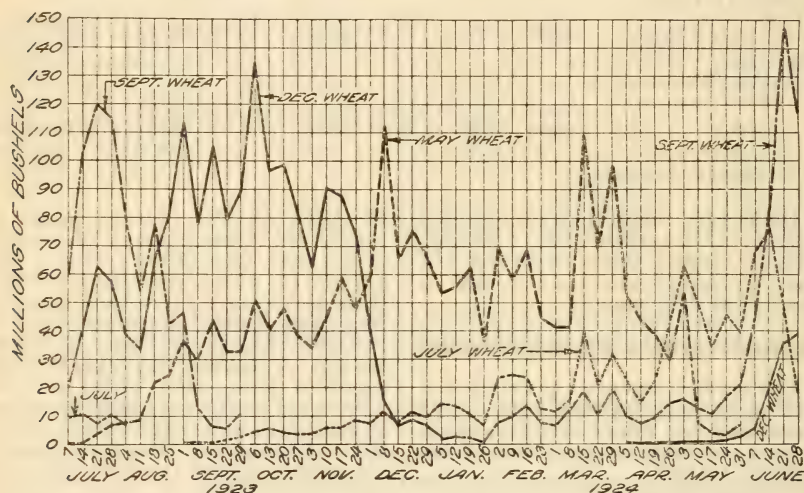


FIG. 6.—Weekly volume of trading in each of the principal wheat futures Chicago Board of Trade, July 1, 1923, to June 30, 1924. (Based on Table 44.)

futures other than the May, the July, the September, and the December.

#### REALTIVE AMOUNTS OF TRADING IN DIFFERENT FUTURES AT DIFFERENT TIMES

The "dominant" future is a convenient designation for that one of the futures in which, during any given period, there is more trading than in any other future. During the three years ended June 30, 1924, May wheat has always been dominant among the wheat futures for the longest period,

to the Government, are set down for wheat futures, corn futures, oats futures, and rye futures in Table 15. When one future is about to give first place to another, the trading in the latter may sometimes pass the trading in the former temporarily for a day or two before establishing itself permanently in first place. The dates given for such cases in Table 15 are those from which the dominance of the future mentioned became unmistakable.



TABLE 15.—*Grain futures: Dates on which each future for each grain became dominant on the Chicago Board of Trade during the period April 1, 1921, to June 30, 1924*

	Date on which designated future became dominant			
	1921	1922	1923	1924
Wheat futures:				
July wheat.....	Apr. 25	Apr. 26	Apr. 11	Apr. 21
September wheat.....	June 21	June 24	June 25	June 10
December wheat.....	Aug. 16	Aug. 11	Aug. 20	-----
May wheat.....	Oct. 20	Nov. 6	Nov. 26	-----
Corn futures:				
July corn.....	Apr. 18	Apr. 15	Apr. 16	May 2
September corn.....	June 13	June 12	June 12	June 5
December corn.....	Aug. 20	Aug. 15	Aug. 22	-----
May corn.....	Oct. 24	Nov. 6	Dec. 1	-----
Oats futures:				
July oats.....	Apr. 20	May 3	May 3	May 26
September oats.....	May 5	June 20	June 13	June 10
December oats.....	Aug. 2	Aug. 16	Aug. 24	-----
May oats.....	Oct. 25	Oct. 17	Nov. 6	-----
Rye futures:				
July rye.....	Apr. 28	May 12	May 2	May 5
September rye.....	Aug. 1	July 5	June 22	June 11
December rye.....	Sept. 1	Sept. 5	Aug. 13	-----
May rye.....	Nov. 23	Oct. 31	Oct. 11	-----

The dates given in Table 15, so far at least as the year July 1, 1923, to June 30, 1924, is concerned, do not correspond exactly with the dates on which the "customers'" open interests in the designated future came to exceed those in any other future. These latter dates for each of the wheat futures for which data are available, were as follows: December wheat, August 17, 1923; May wheat, November 13, 1923; July wheat, April 28, 1924; September wheat, June 12, 1924.

The dates given for the time at which each of the wheat futures and each of the corn futures became dominant, indicate that the dominant future on any given date is almost always one relating to a delivery month separated from that given date by periods ranging from about two to about five or six months.

This fact serves to emphasize the futurity which is the characteristic feature of future trading. The extent to which traders in futures are looking forward into the future is indicated at any given time by the most remote future in which trading is taking place, but the center of market interest lies in the dominant future. This future is never the most remote future, and it is infrequently the nearest future. During the last three years, as stated, it has always been a future for which the delivery month is more than 60 days remote and not more than about 6 months remote.

In order to locate the center of market interest more precisely, some computations for wheat futures and for corn futures have been made, based on the data given in Tables 39 and 40, pages 62 and 63 of this report. The results are exhibited in Table 16.

TABLE 16.—*Wheat futures and corn futures: Average distribution of trading as between the calendar month of delivery and preceding calendar months for twelve wheat futures and twelve corn futures expiring between July 1, 1921, and June 30, 1924*

Month	Average percentage of total trading during month to total trading during life of future	
	Twelve wheat futures	Twelve corn futures
Delivery month.....	2.42	3.6
Month next preceding delivery month.....	15.74	14.4
Second month preceding delivery month.....	23.77	23.8
Third month preceding delivery month.....	19.62	21.6
Fourth month preceding delivery month.....	12.35	14.0
Fifth month preceding delivery month.....	10.58	10.4
Sixth month preceding delivery month.....	6.87	6.4
Seventh month preceding delivery month.....	4.77	3.3
Eighth month preceding delivery month.....	2.93	1.8
Ninth month preceding delivery month.....	.90	.7
Tenth month preceding delivery month.....	.05	.04
Total.....	100.00	100.00

Table 16 shows that on the average there is comparatively little trading in any future during the month in which deliveries in that future are due, and also that there is comparatively little trading in futures for which the date when deliveries are due is as remote as seven months. The center of market

interest, in fact, at any given date appears to be in futures expiring two or three months later. This fact is of special importance for studies of price movements for grain futures, as well as for other purposes, because it indicates which of the price quotations for different futures are of most marked significance at any given time and which of such quotations are most nearly "nominal."

#### VOLUME OF TRADING IN GRAIN FUTURES IN RELATION TO CROPS, RECEIPTS, AND "OPEN INTERESTS"

The statement is sometimes made that the trading in grain futures results in "turning over" the "crop" fifty times, one hundred times, etc. This statement is misleading and does not correspond with the facts. It is misleading because the volume of trading in grain futures represents the "turn-over" of contracts, not the "turnover" of grain. The "turnover" of grain takes place in the cash grain markets, except for the relatively small portion which represents the delivery of grain on futures contracts which are held until maturity. There are no figures available to show what the "turnover" of any grain actually amounts to, i. e., to indicate how many times the "crop" changes ownership. Table 17 shows by calendar years the relation between the yearly volume of trading in futures for each of the principal grains and the size of the crop for the nearest crop year in each case.

TABLE 17.—*Grain futures: Volume of trading in all markets combined, by calendar years and by grains, compared with size of crop for corresponding years, 1921 to 1923*

[In thousands of bushels, i. e., 000 omitted]

	Trading	Crop	Ratio
Wheat:			
1921.....	14, 139, 558	814, 905	17. 35
1922.....	12, 699, 767	867, 598	14. 64
1923.....	10, 082, 284	785, 741	12. 83
Ave.....	12, 307, 203	822, 748	14. 96
Rye:			
1921.....	227, 804	61, 675	3. 69
1922.....	492, 633	103, 362	4. 77
1923.....	463, 828	63, 023	7. 35
Ave.....	394, 755	76, 020	5. 19
Flax:			
1921.....	46, 666	8, 029	5. 81
1922.....	28, 949	10, 375	2. 79
1923.....	38, 848	17, 429	2. 23
Ave.....	38, 154	11, 944	3. 19
Corn:			
1921.....	6, 352, 384	3, 068, 569	2. 07
1922.....	4, 837, 606	2, 906, 020	1. 66
1923.....	4, 649, 055	3, 046, 387	1. 52
Ave.....	5, 279, 682	3, 006, 992	1. 76
Oats:			
1921.....	2, 971, 809	1, 078, 341	2. 76
1922.....	1, 770, 549	1, 215, 803	1. 46
1923.....	897, 606	1, 299, 823	. 69
Ave.....	1, 879, 988	1, 197, 989	1. 57

Table 17 shows that during the three-year period 1921 to 1923 the average ratios between the volume of trading in futures and the size of the crop were 14.96 for wheat, 5.19 for rye, 3.19 for flax, 1.76 for corn, and 1.57 for oats. The differences among these ratios are believed to reflect, in a general way, the influence of three principal factors, as follows: (1) Differences in the extent to which different grains are marketed in the form of grain on the one hand and consumed on the farm or marketed in the form of animals on the other; (2) differences in the extent to which cash transactions in the different grains (marketed in the form of grain) are hedged by transactions in futures, and (3) differences in the extent to which speculative interest in futures has been developed in respect to different grains.

All three of these factors help to explain why the ratio for wheat, for instance, should be more than eight times the ratio for corn. Thus the usual proportion of the wheat crop that is marketed as wheat is much larger than the usual proportion of the corn crop that is marketed as corn. The usual proportion in which each of these grains is shipped out of the county where grown, as estimated by the Division of Crop and Livestock Estimates, is for wheat (27 States) 62.8 per cent and for corn (average 1916-1923) 18.56 per cent—i. e., more than three-fifths of the wheat crop and less than one-fifth of the corn crop. This difference in marketing practice between wheat and corn might, therefore, be expected to explain why the ratio between the volume of futures trading and the size of the crop should be considerably larger for wheat than for corn. There are also the further possibilities (1) that a larger proportion of the wheat that is marketed "moves on hedges" than is the case for corn, and (2) that hedged wheat changes hands more frequently and is more frequently re-hedged than hedged corn. But great weight must still be given to the circumstance that speculative interest in wheat futures has been more highly developed than speculative interest in corn futures. That such is in fact the case is a matter of common knowledge and is in part confirmed by other figures appearing in this report.

A more useful item of information would be the ratio between the total volume of futures transactions and the total volume of transactions in cash grain. The volume of transactions in cash grain would be exhibited by a figure showing in bushels the volume of sales (or purchases) during a given period, and counting every bushel ever sold as many times as it changes



hands. No figures are available on this basis, but Table 18 exhibits a comparison between the volume of futures trading in wheat, corn, and oats, and the receipts of these three grains at 11 primary markets. These 11 markets are those for which figures are regularly given in the Yearbook of the U. S. Department of Agriculture.

TABLE 18.—*Grain futures: Volume of trading in all markets combined, by years and by grains, compared with receipts of grain at 11 primary markets for the period 1921 to 1923*

[In thousands of bushels, i. e., 000 omitted]

	Volume of trading in futures	Receipts of grain	Ratio
Wheat:			
1921.....	14, 139, 558	416, 179	33. 97
1922.....	12, 699, 767	403, 572	31. 47
1923.....	10, 082, 284	375, 505	26. 84
Average.....	12, 307, 203	398, 419	30. 89
Corn:			
1921.....	6, 352, 384	338, 216	18. 78
1922.....	4, 837, 606	375, 112	12. 90
1923.....	4, 649, 055	251, 691	18. 47
Average.....	5, 279, 682	321, 631	16. 41
Oats:			
1921.....	2, 971, 809	217, 207	13. 68
1922.....	1, 770, 549	222, 998	7. 94
1923.....	897, 606	229, 942	3. 90
Average.....	1, 879, 988	223, 382	8. 42

Table 18 shows that for the three-year period the volume of futures trading for wheat was 30.89 times the receipts of wheat at 11 primary markets, for corn 16.41 times, and for oats 8.42 times. These ratios are larger than those expressing the relation between the amount of trading and the size of the crop. The wheat ratio in this case, however, is only about twice the corn ratio, as against about eight times in the case of the ratios expressing the relation between volume of futures transactions and size of crop. The fact that the wheat ratio is closer to the corn ratio when comparison is made between futures trading and receipts reflects in part the circumstance already mentioned regarding the disposition of the two crops, i. e., that more than three-fifths of the wheat crop is shipped out of the county where grown as against less than one-fifth of the corn crop.

A still more instructive comparison is that between the total volume of futures trading in all markets combined on the one hand and, on the other hand, the aggregate of "open interests" in all markets combined. The proper figure to use for this comparison would be the one showing "ultimate" open interests, which is not

available for reasons explained elsewhere.

The figure representing "customers' " open interests, however, in all markets combined, is available for wheat futures. Thus we find that for the crop year 1923-24 the total volume of sales (or purchases) for wheat futures in all markets amounted to 7,054,838,000 bushels during a period of 301 trading days, or a daily average of 23,438,000 bushels. The average "customers' " open interest in wheat futures outstanding at the end of each day, as shown elsewhere, was approximately 120,000,000 bushels. This means that the average day's trading represented a turnover of 19.5 per cent of the average "customers' " open interest, or that the latter turned over, on the average, about once in every five (5.12) trading days, or approximately once a week. Stated otherwise it means that the "life" of the average trade in wheat futures or the period during which the trade remained "open," was at least 5.12 trading days. How much longer than this such average life was we do not know, because we do not know by how much the "true" or "ultimate" open interest exceeded the "customers' " open interest.

The fact that the ratios used express an *average* relationship should be especially noted. The basic figures include, for instance, the large percentage of such "scalping" trades as lived (i. e., remained "open") less than one day as well as the small percentage of such "hedging" trades as lived more than six months. Assuming that trades remaining open less than one day amounted to half the total trades, as indicated by figures for "scratch trades" and for "pit trades" presented elsewhere in this report, then the same reasoning as that employed above indicates that the average "life" of all trades in wheat futures other than "pit trades" was not less than ten days. Calculation similar to the foregoing indicate that the life of the average trade in wheat futures, including "pit trades," in the Chicago Chicago market taken by itself, was during the crop year 1923-24 not less than 4.5 trading days; for 45 large "hedging" accounts (calendar year 1923), not less than two weeks; for 32 large speculative accounts (calendar year 1923), not less than 5.75 trading days.

The average "life" of trades by classes of trading can not be accurately ascertained until the work of classification to which reference is made elsewhere has been brought to completion.



# **VOLUME OF FUTURES TRADING IN RELATION TO THE RANGE AND FREQUENCY OF PRICE FLUCTUATIONS**

The general nature of the relation ship between (1) the volume of trading in wheat futures and (2) the range of price fluctuations for wheat futures, is indicated in the course of the follow-

ing discussion. All of the tables presented relate to the Chicago Board of Trade. Tables 19 to 21 give the information first on a monthly basis, then on a weekly basis, and finally on a daily basis, for each of the last three crop years and for the last half of the crop year 1920-21.

**TABLE 19.—Wheat futures: Monthly volume of trading on the Chicago Board of Trade compared with monthly ranges of price fluctuations, by crop years, during the period January 1, 1921, to June 30, 1924**

Crop year	Volume in thousands of bushels— Monthly volume of trading			Price ranges in cents per bushel— Monthly price range		
	Largest	Smallest	Average	Widest	Narrowest	Average
1920-21 <sup>1</sup> .....	1, 195, 828	830, 828	989, 163. 2	28. 75	21. 00	25. 417
1921-22.....	1, 477, 112	799, 306	1, 067, 859. 8	31. 75	8. 625	16. 917
1922-23.....	1, 027, 873	630, 883	802, 102. 2	12. 875	6. 875	9. 847
1923-24.....	734, 527	308, 534	510, 360. 3	15. 75	3. 875	7. 198

<sup>1</sup> January to June, 1921.

**TABLE 20.—Wheat futures: Weekly volume of trading on the Chicago Board of Trade compared with weekly ranges of price fluctuations, by crop years, during the period January 1, 1921, to June 30, 1924**

Crop year	Volume in thousands of bushels— Weekly volume of trading			Price ranges in cents per bushel— Weekly price range		
	Largest	Smallest	Average	Widest	Narrowest	Average
1920-21 <sup>1</sup> .....	335, 796	145, 647	228, 268. 4	15. 75	6. 25	14. 452
1921-22.....	378, 099	158, 280	246, 429. 2	18. 25	3. 00	7. 608
1922-23.....	325, 591	94, 396	185, 100. 5	7. 75	2. 75	4. 4375
1923-24.....	229, 872	44, 249	117, 775. 4	9. 00	1. 375	3. 300

<sup>1</sup> January to June, 1921.

**TABLE 21.—Wheat futures: Daily volume of trading on the Chicago Board of Trade compared with daily ranges of price fluctuations, by crop years, during the period January 1, 1921, to June 30, 1924**

Crop year	Daily volume of trading			Daily price range		
	Largest	Smallest	Average	Widest	Narrowest	Average
1920-21 <sup>1</sup> .....	72, 260	12, 697	39, 566. 5	10. 25	1. 250	4. 243
1921-22.....	90, 134	12, 285	42 572. 5	8. 75	. 875	2. 937
1922-23.....	76, 644	10, 742	31, 977. 5	5. 25	. 625	1. 755
1923-24.....	51, 471	4, 031	20, 346. 6	3. 75	. 250	1. 254

<sup>1</sup> January to June, 1921.

The price ranges in Tables 19-21 have been obtained by taking the difference between the highest and lowest quotations for the day, week, or month, as the case may be, for the future in which most trading occurred during the month under consideration.

These tables indicate that each of the last two crop years has shown both a smaller average range of fluctuation and a smaller average volume of trading, whether the comparison be on a daily, weekly, or monthly basis. Each of these two years, furthermore, shows both a smaller maximum price range and a smaller minimum price range, for

the day, week, or month, along with smaller maximum and minimum volumes of trading for the same periods. The showing for the period January to June, 1921, however, though exhibiting wider price ranges in most cases, usually exhibits smaller volumes than the succeeding periods. This was shortly after the resumption of trading in wheat futures which had been suspended from August 25, 1917, to July 15, 1920.

Table 22 exhibits, on a different basis, the same tendency for volume of trading and range of price fluctuations to vary together.

TABLE 22.—Wheat futures: Average daily volume of trading on the Chicago Board of Trade compared with average daily range of price fluctuations, by futures, during the "life" of each future, for the principal futures expiring during the period, July, 1921, to June, 1924

Year	May wheat		July wheat		September wheat		December wheat	
	Average daily volume of trading	Average daily price range	Average daily volume of trading	Average daily price range	Average daily volume of trading	Average daily price range	Average daily volume of trading	Average daily price range
	<i>Busheis</i>	<i>Cents</i>	<i>Busheis</i>	<i>Cents</i>	<i>Busheis</i>	<i>Cents</i>	<i>Busheis</i>	<i>Cents</i>
1921.....			21, 146, 000	3. 93	15, 142, 000	3. 44	15, 396, 000	3. 07
1922.....	26, 302, 000	3. 12	13, 410, 000	2. 24	7, 732, 000	1. 88	9, 778, 000	1. 81
1923.....	14, 818, 000	2. 01	9, 922, 000	1. 49	6, 890, 000	1. 42	9, 926, 000	1. 39
1924.....	7, 660, 000	1. 10						

Table 22, it may be noted in passing, represents the aggregation by the Grain Futures Administration of more than 500,000 distinct items. It shows, as suggested earlier that, whatever future be taken for purposes of comparison, the average daily volume of trading and the average daily price range show a general tendency to move together.

Figures already presented (Tables 19 to 22) compare the volume of trading with the range of price fluctuations, regardless of what the frequency of fluctuations of some given size (e. g., 2 cents or 5 cents) may have been. In order to indicate the relation between the volume of trading and the frequency of price fluctuations, Table 23 is presented with accompanying explanations and inferences.

TABLE 23.—Wheat futures: Volume of trading, Chicago, Board of Trade, by half years and by quarters, compared with number of price movements amounting to 5 cents or more during corresponding periods, January 1, 1921, to June 30, 1924

Period	Number of price movements	Volume of trading	
		(Unit: 1,000 bushels)	
1921			
First quarter.....	26	2, 568, 729	
Second quarter.....	26	3, 366, 250	
Half year.....	52	5, 934, 979	
Third quarter.....	15	3, 084, 627	
Half year.....	41	6, 450, 877	
Fourth quarter.....	12	3, 254, 044	
Half year.....	27	6, 338, 671	
1922			
First quarter.....	12	3, 598, 825	
Half year.....	24	6, 852, 869	
Second quarter.....	10	2, 876, 822	
Half year.....	22	6, 475, 647	
Third quarter.....	7	2, 307, 107	
Half year.....	17	5, 183, 929	
Fourth quarter.....	6	2, 289, 791	
Half year.....	13	4, 596, 898	

TABLE 23.—Wheat futures: Volume of trading, Chicago, Board of Trade, by half years and by quarters, compared with number of price movements amounting to 5 cents or more during corresponding periods, January 1, 1921, to June 30, 1924—Continued.

Period	Number of price movements	Volume of trading	
		(Unit: 1,000 bushels)	
1923			
First quarter.....	5	2, 167, 357	
Half year.....	11	4, 457, 148	
Second quarter.....	6	2, 860, 971	
Half year.....	11	5, 028, 328	
Third quarter.....	4	1, 891, 333	
Half year.....	10	4, 752, 304	
Fourth quarter.....	3	1, 652, 450	
Half year.....	7	3, 543, 783	
1924			
First quarter.....	2	1, 162, 231	
Half year.....	5	2, 814, 681	
Second quarter.....	5	1, 418, 309	
Half year.....	7	2, 580, 540	

The price movements counted in Table 23 include all changes in price, as measured from a "low" quotation at one time to a subsequent "high" or from a "high" quotation to a subsequent "low," which amounted to 5 cents or more. Intermediate movements of less than 5 cents are not counted, and when any movement in a given direction happened to extend beyond 5 cents that movement is counted but once, and is allocated to the quarter in which it occurred, or in which the major portion of it occurred, except in cases where single movements running from one quarter into another amounted to 10 cents or more, of which as much as 5 cents fell in each of the quarters; in this case, and this case only, the movement was counted in both quarters. The price quotations employed for the purposes

of the table are in all cases the quotations for a single future, namely, that one of the futures which was most active at the time, or "dominant" in the sense already defined. For price movements extending across dates on which one future was giving first place to another, quotations for the newer future have been used. The table as thus explained shows a considerable degree of coincidence between changes in the number of price movements from one period to another and changes in the volume of trading from one period to another. Twenty-five cases are presented; 12 of these offer opportunity to compare a half-yearly period with the one preceding, and in 8 of these 12 cases an increase or decrease in the number of price movements is accompanied by an increase or decrease, as the case may be, in the volume of trading. Thirteen cases offer opportunity to compare one quarter with the one preceding, and in 10 of these 13 cases an increase or decrease in the number of price movements is accompanied, as the case may be, by an increase or decrease in the volume of trading.

The 5-cent measure is too large to apply on a monthly, weekly, or daily basis, and the period for which the data are available is too short to warrant definitive conclusions. Nevertheless, the comparisons between (1) volume of trading and (2) range and frequency of fluctuations which have been presented in Table 23 and foregoing tables are sufficient to raise a decided presumption. This presumption is that the two factors mentioned tend to change together, e. g., large volume attends rapid and extensive fluctuations, and conversely rapid and extensive fluctuations attend large volume. Small volume also seems to go with fluctuations that are few in number and limited in range.

Further and closer studies into the relation between the volume of trading and price fluctuations are under way. Some of these relate to other grain futures besides wheat futures and to markets other than Chicago, and some of them take account of fluctuations of narrower range and greater frequency than those presented above. For instance, the range and frequency of the fluctuations inside the day are being compared with the volume of trading for the day, and comparisons are being made between the daily volume of trading and the range (in cents) within which the fluctuations

for the day took place. As further and better data accumulate these studies will be carried further and made more precise. The mathematical correlation between the daily volume of trading in wheat futures during the year July 1, 1923 to June 30, 1924, and the range of daily price movement, for the Chicago Board of Trade, has been found to be relatively high (+0.723, probable error 0.02). This figure should be considered in relation to the three charts relating to May wheat, which are published elsewhere in this report, and particularly in relation to the correspondence shown on those charts between days on which the volume of trading was large (or small) and days on which the price moved over a wide (or narrow) range.

The analysis of the trading into its elements, based on the classification of traders which is said elsewhere in this report to be under way, will afford a basis for comparing price fluctuations with the volume of buying and of selling on the part of each of the significant classes of traders and should throw some light upon the extent to which the trading of each of such classes, as a rule, both influences and is influenced by movements of the price.

#### MARKET COMMITMENTS IN GRAIN FUTURES ("OPEN INTERESTS")

On December 31, 1923, market commitments in wheat futures for the Chicago Board of Trade, taking the market as a whole, were as follows:

	Bushels
Item A. Net commitments "on the street" (futures combined)-----	44,392,000
Item B. Net commitments "on the street" (futures separate)-----	46,926,000
Item C. Open commitments (open interests) "on the street"-----	77,818,000
Item D. "Customers' " open interests (open commitments)-----	95,395,000
Item E. "Ultimate " open interests (open commitments)-----	Missing

The separate entries in the foregoing list need to be carefully distinguished from one another. They are labeled with capital letters for convenience of reference in the following discussion. Specific attention is again called to those earlier parts of this report in which a description is given of the way in which transactions in grain futures are made and "cleared" (at Chicago), how records are kept, and how reports are made.

The items on the foregoing list are arranged in order of size, and the fol-



lowing exposition is devoted to the reasons why they differ in size. The explanation is offered because each of the items in question is of use for certain practical purposes, and it is important that persons using them shall not get them confused with one another.

The expression "on the street" is employed according to a practice current in the trade at Chicago, to designate relations among "clearing members," i. e., members of the clearing house of the Board of Trade of the City of Chicago who are parties to the contracts made on the floor of the exchange, as explained elsewhere in this report.

Net commitments "on the street" (futures combined) i. e., item A, are less than net commitments "on the street" (futures separate) i. e., item B, because houses net "long" in one future are sometimes net "short" in another, so that "offsetting" is possible, as will be illustrated later.

Net commitments "on the street" (futures separate) are less than open interests "on the street" by reason of imperfections in the "ringing out" process at Chicago as compared with the operations of a full-fledged clearing house.

Open interests "on the street" are in this case and normally less than "customers'" open interests because purchases made by one house for some of its "customers" offset ("on the street") sales made by the same house for others of its "customers." The "customers'" open interests are for similar reasons less than the missing item, "ultimate" open interests (see pages 68 to 71).

On December 31, 1923, as stated above, the open interests "on the street" (item C) amounted to 77,818,000 bushels, whereas aggregate net commitments "on the street" (item A) amounted to but 44,392,000 bushels. These open interests (item C) were divided among the futures as follows (in bushels):

	May wheat	July wheat	All wheat futures
Open on "bought" side.....	62,595,000	15,451,000	78,046,000
Open on "sold" side.....	62,368,000	15,450,000	77,818,000

The "bought" and "sold" should be exactly equal, both for each future and for the two futures combined,

because every open contract is open on both the "bought" side and the "sold" side. The foregoing figures do not exhibit this perfect equality, due to errors in reporting, but the discrepancy is obviously not so great as to prevent the use of either figure to represent the open interest (one side only, i. e., either side). Throughout this report the practice of using the "sold" side is followed, in line with the practice followed in reporting transactions, i. e., using "sales" figures to represent either "sales" or "purchases."

The net commitments "on the street" (item A) represent, for each "clearing member" and for each future, the difference between (1) the total of open contracts on the "bought" side and (2) the total of open contracts on the "sold" side. This difference is the item called for by article 2, section (d), of the Government regulations: "The net position (of reporting member) at the end of the period covered by the report." On December 31, 1923, the aggregate of these net positions, as shown by the daily reports made to the Grain Futures Administration, was divided among the futures as follows (in bushels):

	May wheat	July wheat	All wheat futures
Bought, i. e., "net long".....	37,860,000	9,050,000	46,910,000
Sold, i. e., "net short".....	37,885,000	9,041,000	46,926,000

It will be observed that such figures in this table as should be equal to each other are not exactly equal, due to certain errors in reporting, as already explained, but the differences are not significant in the present connection.

On the date selected 100 clearing members of the Chicago Board of Trade reported open trades in wheat futures. Twenty-eight of these 100 firms were "long" or "short" in but one future. Of these, 14 were "long" in May wheat only, to the extent of 322,000 bushels, and one firm was "long" in July wheat only, to the extent of 1,000 bushels. Ten firms were "short" in May wheat only, to the extent of 604,000 bushels, and 3 firms were "short" in July wheat only, to the extent of 80,000 bushels.

Twenty-nine firms were "long" in both May wheat (24,591,000) and

July wheat (8,314,000), to the extent of 32,905,000 bushels. Eleven firms were "short" in both May wheat (17,368,000) and July wheat (5,965,000) to the extent of 23,333,000 bushels.

Thirty-two firms were "long" in one future and "short" in the other. Twelve of these 32 were "long" 12,947,000 bushels in May wheat and "short" 2,996,000 bushels in July wheat, or net "long" (combining the futures) 9,951,000 bushels. Twenty of these 32 firms were "short" in May wheat to the extent of 19,913,000 bushels and "long" in July wheat 735,000 bushels, or net "short" (combining the futures) 19,178,000 bushels.

The foregoing presentation illustrates how net commitments "on the street" (futures combined), i. e., item A, came on the date selected to be less

than net commitments "on the street" (futures separate) i. e., item B.

For understanding the economics of the marketing process, item E (the missing item) would be most useful. Lacking that item, item D for a specimen date is presented in Table 24, qualified by the designation "customers," open interests, the quoted appellation "customers," being specially designed to guard against confusing item D with items C and E. The date selected for the purpose is April 30, 1924, both because of the availability of the figures and because this is the date just preceding the delivery month for a future (the May future) which is traditionally the most active and for which certain data on "deliveries" are available for presentation elsewhere.

TABLE 24.—*Grain futures: Aggregate "customers" open interests (item D), by grain and by markets, for April 30, 1924*

Market	Grain futures, in thousands of bushels, i. e., 000 omitted						
	Wheat futures	Corn futures	Oats futures	Rye futures	Barley futures	Flax futures	All grain futures
Chicago.....	74,602	67,461	19,043	8,318	(1)	(1)	169,424
Chicago Open Board.....	1,202	721	135	0	(1)	(1)	2,058
Minneapolis.....	11,208	(1)	2,352	8,572	168	202	22,502
Kansas City.....	8,264	4,233	89	(1)	(1)	(1)	12,586
Duluth.....	<sup>2</sup> 2,759	(1)	(1)	5,596	(1)	899	9,254
St. Louis.....	1,585	1,502	(1)	(1)	(1)	(1)	3,087
Milwaukee.....	221	653	194	313	(1)	(1)	1,381
Total.....	99,841	74,570	21,813	22,799	168	1,101	220,292

<sup>1</sup> No trading and no open contracts.

<sup>2</sup> Durum, 2,752; spring, 7.

Table 24 illustrates, for the date mentioned, the preponderance of the Chicago Board of Trade in respect to open commitments in wheat futures, corn futures, oats futures, and rye futures. It also illustrates the importance in respect to durum of the Duluth market, in respect to barley of the Minneapolis market, and in respect to both barley and flax of the Minneapolis and Duluth markets. The showing is roughly similar all through to that given for the volume of trading in grain futures on page 55 of this report.

Tables relating to "customers" open interests (item D) similar to the above,

but for other dates, are presented as fully as the data permit in Tables 45 to 48, pages 68 to 71.

The accompanying chart (fig. 7) exhibits the movement from month to month of the "customers" open interest in wheat futures for the year ended June 30, 1924.

The information entered as item C on page 74 ("open interests on street") is available for certain dates for certain markets, and is presented in Table 51 for the Chicago market for all dates for which it is available. The averages as of the close of business at the end of each month are given by half years in Table 25.

TABLE 25.—*Grain futures: Average open interests "on the street," Chicago Board of Trade, by half years, for the period January, 1921, to December, 1923*

Grain	Average open interests "on the street," in thousands of bushels, i. e., 000 omitted					
	1921		1922		1923	
	Jan.-June	July-Dec.	Jan.-June	July-Dec.	Jan.-June	July-Dec.
Wheat futures.....	74,921	91,426	89,216	84,035	84,037	78,639
Corn futures.....	94,419	55,387	69,864	55,449	59,504	39,412
Oats futures.....	56,431	70,829	59,802	37,861	25,803	18,399
Rye futures.....	7,157	7,216	7,816	12,005	13,651	11,319
Barley futures.....	455	166	47	57	5	20
All grain futures.....	233,383	225,024	223,745	189,407	183,000	147,789

Table 25 exhibits, for all grain futures combined, a progressive decline in the average amount of the open interests "on the street" from the first half of 1921 to the last half of 1923. The diminishing importance of barley futures in the Chicago market is also exhibited. The relatively large open interests in corn futures in the first half of 1921, as compared with the open interest in wheat futures, is believed to be a reflection of the fact that speculative attention, diverted from wheat futures to corn futures during the period 1917 to 1920, while the wheat futures market was closed, had not yet come back to wheat futures. The figures for all grain futures combined suggest a tendency for the open

interests "on the street" to be larger in the first half of the calendar year than in the second half, but this suggestion is not borne out when the figures for each grain are examined separately. All comparisons among figures in this table, however, for the purpose of disclosing tendencies, must make allowance for the circumstance that open interests "on the street" need not vary, and often do not vary, with "customers" open interests or "ultimate" open interests or any similar factor. This is chiefly because the clearing system at Chicago ("ringing out") is less inefficient at some times than at other times. Table 26 illustrates the presence of this factor.

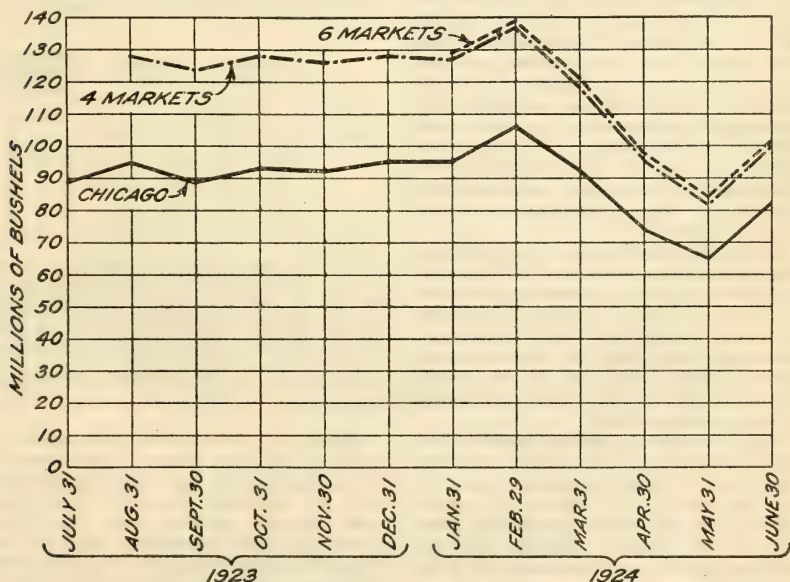


FIG. 7.—"Customers" open interests in wheat futures at monthly intervals for six markets, for four markets, and for the Chicago Board of Trade, during varying periods ended June 30, 1924. (Based on Tables 45 and 46.)



TABLE 26.—*Wheat futures: For Chicago Board of Trade and Minneapolis Chamber of Commerce (clearing association), open interests "on the street" compared with "customers'" open interests, at the end of each month for the period July to December, 1923*

[In thousands of bushels, i. e., 000 omitted]

For the month ending	Chicago				Minneapolis			
	Open interests "on the street"		"Customers'" open interests		Open interests with clearing association		"Customers'" open interests	
	Amount	Change from previous month	Amount	Change from previous month	Amount	Change from previous month	Amount	Change from previous month
1923								
July 31.....	79,346	-----	89,742	-----	<sup>1</sup> 5,756	-----	19,762	-----
Aug. 31.....	96,671	+17,325	95,910	+6,168	6,857	+1,101	12,024	+2,262
Sept. 30.....	63,747	-32,924	89,588	-6,322	8,046	+1,189	14,873	+2,849
Oct. 31.....	71,555	+7,808	93,634	+4,046	9,624	+1,578	17,041	+2,168
Nov. 30.....	82,695	+11,140	92,646	-988	9,660	+36	16,679	-362
Dec. 31.....	77,818	-4,877	95,395	+2,749	9,297	-363	16,468	-211
Average.....	78,639	-----	92,819	-----	8,207	-----	14,475	-----

<sup>1</sup> For August 1, 1923.

The average open interest "on the street" at Chicago, for wheat futures, as shown by Table 26, was 85 per cent of the "customers'" open interest, as against 57 per cent for the corresponding relationship at Minneapolis. The difference is due chiefly to the existence of a full-fledged clearing house at Minneapolis. On one date (August 31, 1923) the open interest "on the street" at Chicago was larger than the "customers'" open interest, a thing which could not happen at Minneapolis. The table shows that an increase (or decrease) in the "customers'" open interest is sometimes accompanied by an opposite movement in the open interest "on the street." During November, for instance, the "customers'" open interest decreased in both markets whereas the open interest "on the street" increased.

The tables relating to open interests which have been presented in this section have related in most instances to but one grain, namely, wheat, for which more comprehensive compilations have been completed than for other grains. Corresponding data for other grains will be made public when available and as occasion offers.

The difference in nature between the "open interests on the street" and the "customers'" open interests is strikingly illustrated by Table 27, which presents, for 30 firms designated elsewhere in this report, figures showing their aggregate open interests of both natures.

TABLE 27.—*Wheat futures: Aggregate open interests "on the street" (both "long" and "short") and aggregate "customers'" open interests (both "long" and "short") at monthly intervals for the period August 31, 1923, to December 31, 1923, for 30 "clearing members" of the Chicago Board of Trade*

[In thousands of bushels, i. e., 000 omitted]

Date	Aggregate long		Aggregate short		Aggregate open (both sides)	
	"On street"	"Customers'"	"On street"	"Customers'"	"On street"	"Customers'"
July 31....	60,298	81,788	59,633	81,095	119,931	162,883
Aug. 31....	74,359	86,778	75,660	88,041	150,019	174,819
Sept. 30....	45,180	80,061	49,943	82,025	95,128	162,086
Oct. 31....	53,875	82,731	55,097	84,158	108,972	166,889
Nov. 30....	62,613	81,454	62,175	81,148	124,788	162,602
Dec. 31....	59,322	83,863	59,021	83,543	118,343	167,406
Aver....	59,774	82,779	60,256	83,335	120,030	166,114

Table 27 shows that the open interests "on the street" for these 30 firms combined, both on the average and at selected monthly intervals, were always smaller than the "customers'" open interests, both on the "long" side and on the "short" side. This means that these 30 firms "owed"

to "the street" less wheat than they were "owed" by "customers," and were "owed" by "the street," less wheat than they "owed" to "customers." In effect, some of trades "open" as among "customers" were "closed" as among "clearing members." "Offsetting" is here illustrated. But this relationship, though a natural one at any grain-futures market which has a full-fledged clearing system and usual in the Chicago market is not inevitable in the latter market, as has been already illustrated in Table 26.

A calculation based on the table shows that open interests "on the street," for these 30 firms on either side and on both sides together, was on the average about 72 per cent of the "customers'" open interests of these same 30 firms. Expressed in a simpler way, these 30 firms usually "owed" to "the street" (and were usually "owed" by "the street") about 72 bushels of wheat for every 100 bushels "owed" to them by "customers" (or "owed" by them to customers). For all the "clearing members" combined the corresponding figures are 85 bushels and 100 bushels.

We have noted above that the open interests ("on the street") for the 30 selected firms constituted on the average 72 per cent of the open interests of the "customers" of these same firms, or in approximate ratio of 72 : 100. The net positions of these 30 firms on these same six dates have also been ascertained, and are presented in Table 28.

TABLE 28.—Wheat futures: Net positions "on the street" for 30<sup>1</sup> "clearing members" of the Chicago Board of Trade at monthly intervals during the period July to December, 1923

Date	Num- ber net long	Aggregate of net long interests	Num- ber net short	Aggregate of net short interests
		<i>Bushels</i>		<i>Bushels</i>
July 31.....	16	27, 231, 000	13	26, 538, 000
Aug. 31.....	18	25, 410, 000	11	26, 673, 000
Sept. 30.....	18	23, 645, 000	12	25, 609, 000
Oct. 31.....	16	28, 420, 000	14	29, 847, 000
Nov. 30.....	14	30, 419, 000	16	30, 113, 000
Dec. 31.....	16	38, 704, 000	14	38, 384, 000
Average.....	-----	28, 971, 000	-----	29, 527, 000

<sup>1</sup> One clearing member not in business until September.

Table 28 shows that on the average about half of these 30 firms were net "long" and the other half net "short" (on the street), and that the net position of the "long" firms was usually

about equal to the net position of the "short" firms, i. e., about 29,000,000 bushels on the average. This 29,000,000 bushels also represents about what the average aggregate open interests ("on the street," one side only) would have been for these 30 firms during this period if the clearing house of the Board of Trade of the City of Chicago were of the complete or full-fledged type, i. e., capable of applying the principle of "offsetting" to all the transactions of all clearing members to the same extent as is done at Kansas City or Minneapolis. Corresponding information for all firms combined is not available.

#### DELIVERIES OF GRAIN ON GRAIN FUTURES CONTRACTS

Deliveries of grain on futures contracts took place during the year in all grains and in all markets and in all of the principal delivery months. Figures showing the amount of such deliveries are available for some grains, some markets, and some delivery months. Figures most nearly complete are those for markets (e. g., Minneapolis) having a full-fledged clearing house through which deliveries are made and by which the amount of such deliveries come to be recorded as a matter of routine. At Minneapolis, for instance, during May, 1924, according to figures believed to be accurate, May wheat contracts amounting to 728,000 bushels were settled by delivery of wheat. One-half of this amount, or 364,000 bushels, stopped in first hands. Wheat taken in on delivery and then delivered out again on contracts one or more times during the month accomplished the settlement of the other half (364,000) of the 728,000 bushels. Referring to this latter item as "redeliveries," the Minneapolis figures for May, 1924, for oats were 355,000 bushels, including "redeliveries" of 32,000 bushels; for rye, 840,000 bushels, "redeliveries" 221,000 bushels; for barley, 43,000 bushels; for flax, 41,000 bushels, "redeliveries" 10,000 bushels.

At Chicago for the same month the information regarding "redeliveries" is not available, except to the extent that it is represented by "notices passed." These "notices" are issued by clearing members who have contracts open on the "sold" side and describe the grain which they stand ready to deliver, giving its grade, the elevator in which it is located, the numbers of the elevator receipts, and certain other items of information. A notice is presented by the clearing member issuing same to some other clearing member holding



the "bought" end of the contract, who may either stop the notice and pay for the grain or "pass" the notice on to some other clearing member standing toward him in relation of buyer. A notice sometimes passes through more than a score of hands before it finally stops, because most houses at Chicago enter the delivery month with contracts open on the "bought" side toward some clearing members and other contracts open on the "sold" side toward other clearing members, as illustrated in the discussion of open interests "on the street" which appears in an earlier section of this report. A notice issued at the beginning of a daily "delivery session" may pass from one clearing member to another until the close of that session. A firm stopping the notice may "redeliver" the same wheat the next day or at some later time in the month, but this requires the issue of a new notice. Consequently the "notices passed" do not represent the full extent to which grain was "redelivered" at Chicago.

The information at present available relating to "deliveries" at Chicago is subject to the foregoing qualification. The information for May, 1924, is presented in Table 29.

TABLE 29.—*Grain futures: Grain "delivered out" and "taken in" on futures contracts, together with "notices passed," Chicago Board of Trade, during the month of May, 1924.*

Grain	Delivered out and taken in	Notices passed	Total
	<i>Bushels</i>	<i>Bushels</i>	<i>Bushels</i>
Wheat.....	12,232,000	38,962,000	51,194,000
Corn.....	6,529,000	22,741,000	29,270,000
Oats.....	4,848,000	14,467,000	19,315,000
Rye.....	3,584,000	5,998,000	9,582,000
Total.....	27,193,000	82,168,000	109,361,000

The amount of grain taken in on futures contracts is necessarily the same as the amount delivered out, but the exact balance necessary to Table 29 has been achieved only by a very considerable amount of effort devoted to revising the reports originally submitted to the Grain Futures Administration.

For all grains combined the "notices passed" amounted to three times the "deliveries"; for wheat, 3.19 times; for corn, 3.48 times; for oats, 2.98 times; and for rye, 1.67 times. These figures indicate that at Chicago, for most grains, about three times as many open

trades were settled by the passage of notices as were settled by the putting out or the taking in of grain. If "redelivered" items were available, which are in ultimate economic nature akin to "notices passed," so that they could be subtracted from "deliveries" and added to "notices passed," this 3-to-1 ratio would be increased, probably by a considerable amount. In any case, the percentage of the total transactions in the May future (during the "life" of the future) settled by other methods than "offsetting" was very small. For all grains combined it was less than 2.7 per cent; for wheat it was somewhat less than 2.6 per cent; for corn, somewhat less than 1.8 per cent; for oats, somewhat less than 6.4 per cent; and for rye, somewhat less than 10.9 per cent. Settlements by delivery, in the strict sense of the term (excluding redeliveries and notices passed), were for wheat less than 0.6 per cent, for corn less than 0.4 per cent, for oats less than 1.6 per cent, and for rye less than 4.1 per cent. Stated approximately, and from another point of view, more than 97 per cent of the trades in May (1924) futures at Chicago, all grains combined, were settled either by "offsetting" or kindred methods; the corresponding percentage for May wheat was 97.5, for May corn 98.2, for May oats 93.6, and for May rye 89.1. The volume of trading in each of these futures upon which the foregoing percentages are based is given in Table 38 on page 61 of this report.

The percentage of settlements by "offsetting" and by other methods varies from time to time. This fact is shown by figures relating to deliveries (and to notices passed) during the month of December, 1923. Deliveries in December were for every grain much smaller than deliveries in May, but they served to settle a larger proportion of the total trades in the December future (during the "life" of the future), except in the case of wheat. For wheat the figure was less than 0.25 per cent and for corn less than 0.5 per cent.

At Minneapolis the percentage of total trades in May (1924) wheat eventually settled by "offsetting" or kindred methods was more than 99 per cent.

The fact that almost all trades in grain futures, whether entered into for speculative purposes or for hedging purposes, are not settled by the delivery of grain on such contracts, has long been a matter of common knowledge. The further fact that neither speculators nor hedgers, as a rule, desire to



make or take delivery, has also been frequently pointed out and emphasized (see, for example, pages 183, 184, Report of the Federal Trade Commission on the Grain Trade, Vol. V, Future Trading Operations in Grain).<sup>2</sup> The figures presented above are to be considered in the light of these facts.

The fact that hedgers do not, as a rule, want to make or to take delivery, is indicated by the history of the transaction in December (1923) wheat for the 45 "hedging" accounts to which reference has already been made. From the beginning of the period of trading in December wheat (June, 1923) until the end of November the total sales of December wheat for the 45 accounts amounted to about 68,250,000 bushels, and the total purchases of December wheat to about 67,700,000 bushels, leaving a combined net position of but a half million bushels, in round numbers, to be closed out during the delivery month (December). The closing out of this position was then accomplished by purchases of December wheat during December amounting to about 5,500,000 bushels, sales amounting to about 4,500,000 bushels, delivered out on contract about 1,500,000 bushels and taken in on contract about 900,000 bushels. The amount delivered out for accounts belonging to this group exceeded the amount taken in for such accounts by 615,000 bushels. It is clear, therefore, that more than 98 per cent of the transactions in December wheat for these 45 hedging accounts were settled by "offsetting" of one form or another and that less than 2 per cent were settled by delivery or receipt of wheat.

Many trades in grain futures remain "open" for but very short periods, as elsewhere pointed out. The closing out of open trades in any given future takes place to a large extent before the beginning of the delivery month. At Chicago, for instance, at the close of business on April 30, 1924, the "customers'" open interest in May wheat amounted to approximately 18,000,000 bushels, having declined to that figure from a maximum of about 76,900,000 bushels on January 3, 1924. The closing out of the May position then in-

volved trades in May wheat during May amounting to approximately 41,000,000 bushels, passage of notices relative to deliveries on May wheat amounting to approximately 39,000,000 bushels and "deliveries" (including "redeliveries" but not notices passed) amounting to approximately 12,200,000 bushels. At Minneapolis the "customers'" open interest in May wheat at the close of business on April 30 amounted to 1,400,000 bushels, having declined to that figure from a maximum of 16,800,000 bushels on December 28, 1923. The closing out of the May position at Minneapolis then involved trades in May wheat during May approximating 1,500,000 bushels and deliveries (including "redeliveries") amounting to 728,000 bushels. During every day of the month of May, both at Minneapolis and at Chicago, the "customers'" open interest in May wheat declined, except that from May 6 to May 7 at Chicago it increased somewhat less than 100,000 bushels. At the close of business on May 29, with one trading day left in May, the "customers'" open interest at Chicago had declined to less than 2,000,000 bushels and at Minneapolis to less than 30,000 bushels. On the last day of the month at Chicago trades in May wheat approximated 3,500,000 bushels, notices passed approximated 2,125,000 bushels, and deliveries approximated 1,250,000 bushels.

#### GRADES OF GRAIN DELIVERABLE ON FUTURES CONTRACTS

The quantity of grain delivered on futures contracts is an item of information which can be fully appreciated only in comparison with information regarding the quality of grain delivered, i. e., its class, its grade, and its place within the grade, as near "the bottom of the grade" or near "the top of the grade." Some information has been collected on these matters, and more is being collected. The importance of such information arises from the fact that as each future expires, under ordinary conditions, the price thereof tends to approximate more and more closely the price ruling in the cash grain or "sample" market for the precise kind and quality of grain that is being generally delivered on futures contracts, subject to the price differential, if any, fixed by the contract. Precise knowledge regarding such kind and quality is not fully available before the delivery month comes around, and the attendant uncertainty is a factor of some consequence in the valuation placed on the future by the market and registered in the market price.

<sup>2</sup> "When a miller hedges on the wheat in his mill, or on wheat purchased and under contract of delivery to him, by selling short, he distinctly does not intend to deliver that wheat, because he intends to grind it into flour; and getting down to the naked truth, he does not contemplate buying and delivering any other wheat on his contract of sale. He may know that delivery would be involved if he allowed his short sale to mature, but allowing it to mature does not occur to him. He fully intends from the beginning, to buy against his hedging contract when the need for insurance is passed." (Kansas v. Rosenbaum, cited elsewhere in this report.)

Pending the assembly of information showing the precise kind and quality of grain that has been delivered the following information is presented regarding the kinds and qualities that are deliverable in the different markets, under the rules made by the respective exchanges, with the rates of premium or discount established by the rules of these exchanges. The information is codified in such form as to enable comparisons between different markets to be made readily. It is believed to be accurate as of the date August 16, 1924, for the markets listed. The rules fixing the premiums and discounts are seldom changed, notwithstanding changes in general price levels and changes in the price differences among different grades ruling in the "sample" market. Certain qualifications and exceptions applying to tabulated items are inserted quoting rules and parts thereof in footnotes. The information for Chicago applies both to the Board of Trade of the City of Chicago and to the Chicago Open Board of Trade because the latter has by general rule adopted the regulations of the former concerning deliverable grades, premiums, and discounts.

Three markets are not included in the tabulations; namely, the Baltimore Chamber of Commerce, the Los Angeles Grain Exchange, and the Grain Trade Association of the San Francisco Chamber of Commerce. The facts with regard to these three markets are given separately after all the tables have been presented. The same information for the Winnipeg Grain Exchange, the only other North American market trading in grain futures, is also given separately.

All the information included in these tables with reference to deliverable grades, not only at Chicago but at virtually all of the other markets, is subject to whatever amplifications may result from the following rule or its general equivalent: "On contracts for grain or flaxseed for future delivery the tender of a higher grade of the same kind of grain or flaxseed shall be deemed sufficient." The quotation is from the rules of the Board of Trade of the City of Chicago. More or less significant departures from the language of the Chicago rule are found in various markets.

TABLE 30.—Wheat futures: Grades of wheat deliverable on future contracts, at the contract price and at indicated premiums or discounts, for each of six grain-futures markets of the United States

Wheat	Chicago	Kansas City	St. Louis		Milwaukee	Minneapolis <sup>1</sup>		Duluth	
			Hard winter contract	Red winter contract		Spring wheat contract	Winter wheat contract	Spring wheat contract	Winter wheat contract
Grade No. 1									
Hard Spring.....	+1½ cents				+1½ cents.	+4 cents.		+4 cents	
Dark Northern Spring.....	Contract price.				Contract price.	+2 cents.		Contract price.	
Northern Spring.....						Contract price.		Contract price.	
Red Spring.....									
Amber Durum.....									
Durum.....									+2 cents. Contract price.
Mixed Durum.....									
Dark Hard Winter.....	+1½ cents	Contract price.	Contract price.		+1½ cents.			Contract price.	
Hard Winter.....	Contract price.	do.	do.		Contract price.			do.	
Yellow Hard Winter.....	do.	do.	do.		do.			do.	
Red Winter.....	do.		Contract price.		do.			do.	
Hard White.....								-5 cents	
Grade No. 2									
Dark Northern Spring.....	+1½ cent				+1½ cent.	-1 cent.		-1 cent.	
Northern Spring.....	Contract price.				Contract price.	-3 cents.		-3 cents.	
Red Spring.....									
Amber Durum.....									
Durum.....									Contract price.
Mixed Durum.....									-2 cents.
Dark Hard Winter.....	+½ cent.	Contract price.	Contract price.		+½ cent.			Contract price.	
Hard Winter.....	Contract price.	do.	do.		Contract price.			do.	
Yellow Hard Winter.....	do.	do.	do.		do.			do.	
Red Winter.....	do.		Contract price.		do.			do.	
Hard White.....								-5 cents.	

<sup>1</sup> At Minneapolis "unless otherwise specified, all offers to buy or sell wheat for future delivery shall be understood to refer to the spring-wheat future."



TABLE 30.—Wheat futures: Grades of wheat deliverable on future contracts, at the contract price and at indicated premiums or discounts, for each of six grain-futures markets of the United States—Continued

Wheat	Chicago	Kansas City	St. Louis		Milwaukee	Minneapolis		Duluth		
			Hard winter contract	Red winter contract		Spring wheat contract	Winter wheat contract	Spring wheat contract	Winter wheat contract	Durum wheat contract
Dark Northern Spring.....	— 8 cents.	.....	.....	.....	— 8 cents.	.....	.....	— 18 cents.	— 8 cents.	.....
Northern Spring.....	.do.	.....	.....	.....	.do.	.....	.....	— 20 cents.	.do.	.....
Red Spring.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Amber Durum.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Durum.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dark Hard Winter.....	— 5 cents.	— 5 cents.	— 5 cents.	.....	— 5 cents.	.....	.....	.....	— 5 cents.	— 4 cents.
Hard Winter.....	.do.	.do.	.do.	.....	.do.	.....	.....	.....	.do.	— 6 cents.
Yellow Hard Winter.....	.do.	.do.	.do.	.....	.do.	.....	.....	.....	.do.	.....
Red Winter.....	.do.	.do.	— 5 cents.	.....	.do.	.....	.....	.....	.do.	.....

TABLE 31.—*Corn futures: Grades of corn deliverable on futures contracts, at the contract price and at indicated premiums or discounts, for each of five grain-futures markets of the United States*

Corn	Chicago	Kansas City	St. Louis	Milwaukee	Minneapolis
<i>Grade No. 1</i>					
White.....	+½ cent....	Contract price.	Contract price.	+½ cent....	+½ cent.
Yellow.....	do.....	do.....	do.....	do.....	Do.
Mixed.....	Contract price.	do.....	do.....	Contract price.	Contract price.
<i>Grade No. 2</i>					
White.....	+½ cent....	Contract price.	Contract price.	+½ cent....	+½ cent.
Yellow.....	do.....	do.....	do.....	do.....	Do.
Mixed.....	Contract price.	do.....	do.....	Contract price.	Contract price.
<i>Grade No. 3</i>					
White.....	-2 cents....	-2½ cents.	-2 cents <sup>1</sup>	-2 cents....	Do.
Yellow.....	do.....	do.....	do. <sup>1</sup>	do.....	Do.
Mixed.....	-2½ cents.	do.....	do. <sup>1</sup>	-2½ cents.	-2½ cents.
<i>Grade No. 4</i>					
White.....	-4½ cents <sup>2</sup>	-----	-----	-4½ cents <sup>2</sup>	-4½ cents. <sup>3</sup>
Yellow.....	do. <sup>2</sup>	-----	-----	do. <sup>2</sup>	Do. <sup>3</sup>
Mixed.....	-5 cents <sup>2</sup>	-----	-----	-5 cents <sup>2</sup>	-5 cents. <sup>3</sup>

<sup>1</sup> "No. 3 White corn, No. 3 Yellow corn, and No. 3 Mixed corn can not be delivered during the months of March, April, and May, except at 4 cents per bushel discount under contract price."

<sup>2</sup> "Any No. 4 corn, either white, yellow, or mixed, may be delivered only during the months of November, December, January, and February."

<sup>3</sup> "No. 4 corn of the new crop can be delivered only during the months of November, December, January, and February. Provided further, that No. 4 corn, whose moisture content does not exceed the maximum required for No. 3 corn, may be delivered on contract during the balance of the year, but in no case shall more than 25 per cent of No. 4 corn be applied on contract during any time of the year."

TABLE 32.—*Oats futures: Grades of oats deliverable on futures contracts, at the contract price and at indicated premiums or discounts, for each of five grain futures markets of the United States*

Oats	Chicago	Kansas City	St. Louis	Milwaukee	Minneapolis
Grade No. 1, white.....	+½ cent..	+½ cent..	Contract price.	+½ cent..	+½ cent.
Grade No. 2, white.....	Contract price.	do.....	do.....	Contract price.	Contract price.
Grade No. 3, white.....	-1½ cents	Contract price. <sup>1</sup>	-1½ cents	-1½ cents	-1½ cents.

<sup>1</sup> When testing 26 pounds or better.

TABLE 33.—*Rye futures: Grades of rye deliverable on futures contracts, at the contract price and at indicated premiums or discounts, for each of four grain-futures markets of the United States*

Rye	Chicago	Milwaukee	Minneapolis	Duluth
Grade No. 1.....	Contract price.	-----	Contract price.	-----
Grade No. 2.....	do.....	Contract price.	do.....	Contract price.
Grade No. 3.....	-5 cents....	-5 cents....	-3 cents....	-3 cents.

TABLE 34.—*Barley futures: Grades of barley deliverable on futures contracts, at the contract price and at indicated premiums or discounts, for each of four grain-futures markets of the United States*

Barley	Chicago	Milwaukee	Minneapolis	Duluth
Grade No. 1:				
Barley.....	Contract price		Contract price	
Bay brewing.....	do			
Chevalier.....	do			
Grade No. 2:				
Barley.....	do	Contract price	Contract price	Contract price
Bay brewing.....	do			
Chevalier.....	do			
Grade No. 3:				
Barley.....	-7 cents	-7 cents	-7 cents	-5 cents
Bay brewing.....	-7 cents			
Chevalier.....	-7 cents			
Bay brewing mixed	-9 cents			
Chevalier mixed	-9 cents			

TABLE 35.—*Flaxseed futures and kafir futures: Grades of flaxseed deliverable on futures contracts at Minneapolis and Duluth and of kafir at Kansas City, deliverable at the contract price and at indicated premiums and discounts*

	Kafir corn	Flaxseed	
	Kansas City	Minneapolis	Duluth
Grade No. 2:			
White kafir.....	Contract price	Contract price	Contract price
Milo maize.....	-3 cents	do	
Feterita.....	-3 cents		
Mixed grade.....	-3 cents		(1)
Grade No. 3:			
White kafir.....	-1½ cents		
Milo maize.....	-4½ cents		
Feterita.....	-4½ cents		
Mixed grade <sup>2</sup> .....	-4½ cents		
Grade No. 1:			
Flaxseed.....			
Northwestern.....		do	
Grade No. 2: Flaxseed			

<sup>1</sup> Deliverable at penalty of 2 per cent of the contract price.<sup>2</sup> Consisting of kafir corn, milo maize or feterita.

The Grain Trade Association of the San Francisco Chamber of Commerce is authorized by the Secretary of Agriculture to trade in barley futures only. A grade known there as Feed Barley No. 1 is deliverable at the contract price, while Dark Feed Barley No. 1 is deliverable at a discount of 5 cents per cental. The Los Angeles Grain Exchange, similarly authorized to trade in barley, provides only for delivery of Feed Barley No. 2, and at the contract price. The Los Angeles Grain Exchange is also formally authorized to trade in sorghums and corn for future delivery, but the present rules of the exchange as published contain no reference to deliverable grades of these grains. This may be due to the fact that there is at present no trading at Los Angeles in any grain futures except barley futures.

Both these Pacific coast markets designate their contracts as "time contracts" and provide for a standard unit of trading of 100 tons.

The rules of the Baltimore Chamber of Commerce provide for trading in

both wheat futures and corn futures. Deliverable grades of wheat, all at contract price, are grades Nos. 1 and 2 Red Winter wheat and grades Nos. 1 and 2 Red Winter garlicky wheat. Deliverable grades of corn, all at contract price, are grades No. 1, 2, and 3, White corn, Yellow corn, and Mixed corn.

The rules of the Winnipeg Grain Exchange provide for trading in futures for wheat, corn, oats, rye, barley, and flaxseed. The deliverable grades are all specified according to Canadian standards and are as indicated in the following statement, subject to the qualification that in delivering wheat, oats, or barley a higher grade than the contract grade may be delivered at the contract price.

*Wheat.*—Deliverable at contract price, No. 1 Manitoba Northern wheat; at discount of 3 cents per bushel, No. 2 Manitoba Northern wheat; at discount of 8 cents per bushel, No. 3 Manitoba Northern wheat.

*Oats.*—Deliverable at contract price, No. 2 Canada Western oats; at discount of 3 cents per bushel, No. 3



Canada Western oats and Extra No. 1 Feed oats; at a discount of 5 cents per bushel, No. 1 Feed oats.

*Rye*.—Deliverable at contract price, No. 1 Canada Western rye, No. 2 Canada Western rye.

*Barley*.—Deliverable at contract price, No. 3 Canada Western barley; at discount of 5 cents per bushel No. 4 Canada Western barley.

*Flaxseed*.—Deliverable at contract price, No. 1 North Western Canada flaxseed; at discount of 4 cents per bushel, No. 2 Canada Western flaxseed.

The foregoing information concerning deliverable grades, as these are now established by the rules of the respective exchanges represented, is here presented in codified form (as far as possible) both for ready reference and in order that the similarities and differences among the different markets may be noted easily.

In view of the situation here outlined, affecting as it does at times the market valuation of the futures, the Grain Futures Administration has begun to take measures for obtaining information concerning the exact grades, types, and qualities of grain that are actually delivered on grain futures contracts in the different markets of the United States.

#### MARKET PRICES OF GRAIN FUTURES AND MARKET PRICES OF CASH GRAIN

Much interest attaches to the relation between price movements of grain futures and price movements of cash grain. The view of the Grain Futures Administration is that fresh light on this subject requires that it be

seen in proper perspective, which involves prosecution of studies based on series of quotations for grain futures and for cash grain that are strictly comparable as to time, place, and the grade of grain involved. Studies based on the published prices of futures in one market and cash grain in another, or on prices of futures at one time of day and prices of cash grain at another, or on prices of futures reflecting some more or less uncertain quality of grain inside the wide limits of a single grade and the published quotations for such qualities for that grade as happen from day to day to come to the cash grain market, are quite as likely to obscure the subject as to illuminate it. Steps toward improving the quality of the fundamental data are therefore in contemplation.

Parties engaged in the storage of grain, either inside or outside the terminal markets, have a very direct interest in this matter, because they wish to understand why the futures sometimes do and sometimes do not sell at a price high enough to cover storage charges. The various ways in which such charges are calculated by different parties need analysis. Another relevant question, upon which a field study is being started, has to do with the extent to which country elevators and other elements of the grain trade make use of the hedging facilities afforded by the grain futures markets, together with the circumstances which incline some of these elements of the trade to resort to the practice more generally than other such elements.

TABLE 36.—*Grain futures: Volume of trading in seven markets combined, by grains and for all grains combined, by months, with totals by quarters and by calendar years, during the period January, 1921, to June, 1924*

Month	Volume of trading, in thousands of bushels, i. e., 000 omitted						
	Wheat futures	Corn futures	Oats futures	Rye futures	Barley futures	Flax futures	All grain futures
1921							
January.....	977,435	720,368	202,816	19,299	2,986	1,714	1,924,618
February.....	969,311	674,759	182,657	12,210	1,798	1,716	1,842,451
March.....	1,025,877	678,068	241,892	15,182	2,016	1,755	1,964,790
Quarter.....	2,972,623	2,073,195	627,365	46,691	6,800	5,185	5,731,859
April.....	1,364,256	708,669	304,455	24,107	4,493	6,588	2,412,568
May.....	1,152,593	669,389	298,234	18,335	1,780	2,827	2,143,168
June.....	1,294,505	715,040	315,291	17,410	2,702	6,183	2,351,131
Quarter.....	3,811,354	2,093,098	917,980	59,852	8,975	15,598	6,906,857
July.....	1,092,768	537,685	270,220	19,133	1,216	3,420	1,924,442
August.....	1,070,407	442,583	290,382	22,169	3,807	4,408	1,833,756
September.....	1,428,273	359,763	265,888	22,582	2,002	4,829	2,083,337
Quarter.....	3,591,448	1,340,031	826,490	63,884	7,025	12,657	5,841,535
October.....	1,349,403	277,150	243,685	20,606	1,704	5,394	1,897,942
November.....	1,288,663	290,989	206,813	21,551	3,807	5,380	1,817,203
December.....	1,126,067	277,921	149,476	15,220	918	2,452	1,572,054
Quarter.....	3,764,133	846,060	599,974	57,377	6,429	13,226	5,287,199
Total.....	14,139,558	6,352,384	2,971,809	227,804	29,229	46,666	23,767,450

TABLE 36.—*Grain futures: Volume of trading in seven markets combined, by grains and for all grains combined, by months, with totals by quarters and by calendar years, during the period January, 1921, to June, 1924—Continued*

Month	Volume of trading, in thousands of bushels, i. e., 000 omitted						
	Wheat futures	Corn futures	Oats futures	Rye futures	Barley futures	Flax futures	All grain futures
1922							
January.....	912, 787	171, 534	85, 271	6, 909	714	1, 610	1, 178, 826
February.....	1, 493, 897	533, 200	199, 052	28, 496	624	1, 948	2, 256, 409
March.....	1, 655, 809	575, 063	204, 513	23, 933	1, 666	1, 650	2, 462, 604
Quarter.....	1, 406, 656	1, 279, 797	488, 836	59, 338	3, 004	5, 208	5, 897, 839
April.....	1, 173, 515	299, 346	160, 677	25, 948	1, 434	1, 555	1, 662, 475
May.....	971, 334	290, 598	136, 780	28, 390	840	1, 176	1, 429, 118
June.....	1, 087, 189	401, 734	206, 864	30, 008	1, 502	1, 512	1, 728, 809
Quarter.....	3, 232, 038	991, 678	504, 321	84, 346	3, 776	4, 243	4, 820, 402
July.....	859, 524	358, 485	119, 066	37, 914	922	1, 373	1, 377, 284
August.....	978, 046	414, 720	145, 135	61, 462	1, 982	2, 746	1, 604, 091
September.....	838, 398	375, 588	132, 797	56, 974	1, 839	4, 032	1, 409, 628
Quarter.....	2, 675, 968	1, 148, 793	396, 998	156, 350	4, 743	8, 151	4, 391, 003
October.....	812, 451	494, 478	138, 882	57, 635	1, 965	5, 230	1, 510, 641
November.....	864, 983	456, 827	95, 938	77, 282	2, 349	3, 689	1, 501, 068
December.....	1, 052, 671	466, 033	145, 574	57, 682	1, 667	2, 428	1, 725, 955
Quarter.....	2, 730, 105	1, 417, 338	380, 394	192, 599	5, 881	11, 347	4, 737, 664
Total.....	12, 699, 767	4, 837, 606	1, 770, 549	492, 633	17, 404	28, 949	19, 846, 908
1923							
January.....	951, 193	395, 189	79, 656	39, 128	947	1, 303	1, 467, 416
February.....	814, 094	410, 720	93, 461	20, 711	789	978	1, 340, 753
March.....	726, 598	298, 678	61, 047	26, 902	621	896	1, 114, 742
Quarter.....	2, 491, 885	1, 104, 587	234, 164	86, 741	2, 357	3, 177	3, 922, 911
April.....	1, 199, 883	541, 917	105, 625	59, 631	1, 637	1, 570	1, 910, 263
May.....	1, 065, 717	548, 891	101, 082	45, 718	630	1, 286	1, 763, 324
June.....	1, 062, 329	416, 625	66, 047	59, 429	842	1, 312	1, 606, 584
Quarter.....	3, 327, 929	1, 507, 433	272, 754	164, 778	3, 109	4, 168	5, 280, 171
July.....	807, 048	326, 406	62, 151	25, 286	1, 001	2, 001	1, 223, 893
August.....	784, 518	280, 695	78, 475	42, 164	1, 447	3, 246	1, 190, 545
September.....	679, 334	305, 956	76, 079	42, 425	1, 500	7, 514	1, 112, 808
Quarter.....	2, 270, 900	913, 057	216, 705	109, 875	3, 948	12, 761	3, 527, 246
October.....	784, 981	444, 577	69, 648	32, 826	951	9, 194	1, 342, 177
November.....	677, 701	394, 517	48, 945	42, 559	1, 123	6, 040	1, 170, 885
December.....	528, 888	284, 884	55, 390	27, 049	558	3, 508	900, 277
Quarter.....	1, 991, 570	1, 123, 978	173, 983	102, 434	2, 632	18, 742	3, 413, 339
Total.....	10, 082, 284	4, 649, 055	897, 606	463, 828	12, 046	38, 848	16, 143, 667
1924							
January.....	372, 661	456, 910	70, 285	14, 569	319	1, 746	916, 490
February.....	417, 114	337, 850	49, 940	13, 041	279	1, 454	819, 678
March.....	573, 250	441, 760	73, 820	28, 384	461	1, 841	1, 139, 516
Quarter.....	1, 383, 025	1, 236, 520	194, 045	55, 994	1, 059	5, 041	2, 875, 684
April.....	451, 186	323, 243	55, 268	50, 205	439	1, 753	882, 094
May.....	373, 876	287, 994	41, 662	24, 869	231	1, 379	730, 011
June.....	850, 055	426, 320	89, 435	75, 407	209	966	1, 442, 392
Quarter.....	1, 675, 117	1, 037, 557	186, 365	150, 481	879	4, 098	3, 054, 497
Total.....	3, 058, 142	2, 274, 077	380, 410	206, 475	1, 938	9, 139	5, 930, 181

TABLE 37.—*Grain futures: Volume of trading at seven markets, by markets, by months and by grains, for the period January, 1921, to June, 1924*

[In thousands of bushels, i. e., 000 omitted]

Months and markets	Wheat futures	Corn futures	Oats futures	Rye futures	Barley futures	Flax futures	All grain futures
1921							
January:							
Chicago	838,400	661,267	180,489	16,376	824		1,697,356
Chicago Open Board	5,315	28,939	5,749				40,003
Minneapolis	86,813		16,239	2,431	2,162	668	108,313
Kansas City	33,038	14,599	219				47,856
Duluth	11,270			492		1,046	12,808
St. Louis	2,599	15,563	120				18,282
Milwaukee	(1)	(1)	(1)	(1)			
Total	977,435	720,368	202,816	19,299	2,986	1,714	1,924,618
February:							
Chicago	830,893	616,954	163,716	10,541	403		1,622,507
Chicago Open Board	10,599	27,638	5,035				43,272
Minneapolis	79,341		13,440	1,395	1,395	645	96,216
Kansas City	31,730	13,592	296				45,618
Duluth	12,928			274		1,071	14,273
St. Louis	3,820	16,575	170				20,565
Milwaukee	(1)	(1)	(1)	(1)			
Total	969,311	674,759	182,657	12,210	1,798	1,716	1,842,451
March:							
Chicago	899,436	605,962	215,021	13,469	465		1,734,353
Chicago Open Board	16,225	29,233	8,391				53,849
Minneapolis	63,488		16,800	1,356	1,551	822	84,017
Kansas City	35,388	18,049	168				53,605
Duluth	7,099			345		933	8,377
St. Louis	3,455	22,612	410				26,477
Milwaukee	786	2,212	1,102	12			4,112
Total	1,025,877	678,068	241,892	15,182	2,016	1,755	1,964,790
April:							
Chicago	1,195,828	635,080	266,632	22,003	482		2,120,025
Chicago Open Board	25,997	31,953	5,572				63,522
Minneapolis	77,350		29,460	1,339	4,011	2,589	114,749
Kansas City	43,519	19,432	460				63,411
Duluth	13,133			731		3,999	17,863
St. Louis	6,680	19,547	350				26,577
Milwaukee	1,749	2,657	1,981	34			6,421
Total	1,364,256	708,669	304,455	24,107	4,493	6,588	2,412,568
May:							
Chicago	1,024,087	617,659	269,334	16,919	436		1,928,435
Chicago Open Board	18,178	21,278	4,658				44,114
Minneapolis	49,894		21,960	870	1,344	1,086	75,154
Kansas City	41,792	15,752	300				57,844
Duluth	8,141			499		1,741	10,381
St. Louis	9,014	12,087	215				21,316
Milwaukee	1,487	2,613	1,767	47			5,914
Total	1,152,593	669,389	298,234	18,335	1,780	2,827	2,143,158
June:							
Chicago	1,146,335	661,946	286,385	15,385	106		2,110,157
Chicago Open Board	19,525	19,305	5,411				44,241
Minneapolis	61,524		20,875	1,158	2,596	2,731	88,884
Kansas City	45,469	19,124	703				65,296
Duluth	11,073			821		3,452	15,346
St. Louis	9,624	10,889	35				20,548
Milwaukee	955	3,776	1,882	46			6,659
Total	1,294,505	715,040	315,291	17,410	2,702	6,183	2,351,131
July:							
Chicago	959,604	497,378	246,060	17,286	210		1,720,538
Chicago Open Board	14,889	14,095	5,758				34,742
Minneapolis	54,055		16,174	985	1,006	1,373	73,593
Kansas City	48,107	16,494	384				64,985
Duluth	5,428			839		2,047	8,314
St. Louis	10,315	7,659	95				18,069
Milwaukee	370	2,059	1,749	23			4,201
Total	1,092,768	537,685	270,220	19,133	1,216	3,420	1,924,442

1 Not available



TABLE 37.—*Grain futures: Volume of trading at seven markets, by markets, by months and by grains, for the period January, 1921, to June, 1924—Continued*

[In thousands of bushels, i. e., 000 omitted]

Months and markets	Wheat futures	Corn futures	Oats futures	Rye futures	Barley futures	Flax futures	All grain futures
1921							
August:							
Chicago	906,764	405,971	251,515	17,366	547		1,582,163
Chicago Open Board	18,557	11,067	4,749				34,373
Minneapolis	58,528		30,048	1,361	3,259	1,689	94,885
Kansas City	51,687	17,831	2,239				71,757
Duluth	20,177			3,373		2,719	26,269
St. Louis	14,377	6,312	115				20,804
Milwaukee	317	1,402	1,716	69	1		3,505
Total	1,070,407	442,583	290,382	22,169	3,807	4,408	1,833,756
September:							
Chicago	1,218,259	334,495	242,003	17,063	310		1,812,130
Chicago Open Board	24,846	10,252	4,959				40,057
Minneapolis	81,521		16,993	1,736	1,688	1,750	103,688
Kansas City	54,876	9,700	410				64,986
Duluth	27,018			3,705		3,079	33,802
St. Louis	20,767	4,061	125				24,953
Milwaukee	986	1,255	1,398	78	4		3,721
Total	1,428,273	359,763	265,888	22,582	2,002	4,829	2,083,337
October:							
Chicago	1,157,303	262,078	220,588	17,400	253		1,657,622
Chicago Open Board	24,727	6,509	2,824				34,060
Minneapolis	71,392		18,289	1,567	1,448	1,584	94,280
Kansas City	52,741	5,651	518				58,910
Duluth	25,919			1,612		3,810	31,341
St. Louis	16,341	1,994	10				18,345
Milwaukee	980	918	1,456	27	3		3,384
Total	1,349,403	277,150	243,685	20,606	1,704	5,394	1,897,942
November:							
Chicago	1,109,946	271,606	173,926	16,366	268		1,572,112
Chicago Open Board	28,110	6,761	1,847				36,718
Minneapolis	62,716		28,618	2,810	3,539	1,689	99,372
Kansas City	47,945	9,297	1,078				58,320
Duluth	22,061			2,333		3,691	28,085
St. Louis	16,514	2,346	10				18,870
Milwaukee	1,371	979	1,334	42			3,726
Total	1,288,663	290,989	206,813	21,551	3,807	5,380	1,817,203
December:							
Chicago	986,795	259,908	138,019	12,290	106		1,397,118
Chicago Open Board	30,812	5,151	1,044				37,007
Minneapolis	41,824		8,783	1,632	811	993	54,043
Kansas City	41,268	9,017	607				50,892
Duluth	10,805			1,221		1,459	13,485
St. Louis	13,351	2,656	55				16,062
Milwaukee	1,212	1,189	968	77	1		3,447
Total	1,126,067	277,921	149,476	15,220	918	2,452	1,572,054
1922							
January:							
Chicago	799,306	161,854	77,200	4,746	45		1,043,151
Chicago Open Board	28,740	2,833	861				32,434
Minneapolis	34,298	107	5,529	919	669	760	42,282
Kansas City	30,023	4,874	801				35,698
Duluth	6,703			1,211		850	8,764
St. Louis	11,890	854					12,744
Milwaukee	1,828	1,012	880	33			3,753
Total	912,788	171,534	85,271	6,909	714	1,610	1,178,826
February:							
Chicago	1,322,407	499,385	180,796	24,394	40		2,027,022
Chicago Open Board	36,856	8,583	2,314				47,753
Minneapolis	46,482	1,427	13,609	2,035	584	891	65,028
Kansas City	55,319	18,362	745				74,426
Duluth	8,917			1,909		1,057	11,883
St. Louis	21,090	3,000	150				24,240
Milwaukee	2,018	2,443	1,438	158			6,057
Total	1,493,089	533,200	199,052	28,496	624	1,948	2,256,409

TABLE 37.—*Grain futures: Volume of trading at seven markets, by markets, by months and by grains, for the period January, 1921, to June, 1924—Continued*

[In thousands of bushels, i. e., 000 omitted]

Months and markets	Wheat futures	Corn futures	Oats futures	Rye futures	Barley futures	Flax futures	All grain futures
<b>1922</b>							
<b>March:</b>							
Chicago.....	1,477,112	537,180	182,845	18,457	20	-----	2,215,614
Chicago Open Board.....	43,588	10,321	1,726	-----	-----	-----	55,635
Minneapolis.....	47,490	1,796	16,864	2,103	1,646	693	70,592
Kansas City.....	50,002	18,369	743	-----	-----	-----	69,114
Duluth.....	12,328	-----	-----	3,247	-----	957	16,532
St. Louis.....	23,031	4,827	770	-----	-----	-----	28,628
Milwaukee.....	2,228	2,570	1,565	126	-----	-----	6,489
Total.....	1,655,779	575,063	204,513	23,933	1,666	1,650	2,462,604
<b>April:</b>							
Chicago.....	1,040,944	277,618	134,030	18,534	15	-----	1,471,141
Chicago Open Board.....	31,930	4,460	1,004	-----	-----	-----	37,394
Minneapolis.....	35,306	1,495	21,022	2,406	1,414	615	62,258
Kansas City.....	41,159	10,943	2,450	-----	-----	-----	54,552
Duluth.....	10,815	-----	-----	4,899	-----	940	16,654
St. Louis.....	10,699	2,356	780	-----	-----	-----	13,835
Milwaukee.....	2,662	2,474	1,391	109	5	-----	6,641
Total.....	1,173,515	299,346	160,677	25,948	1,434	1,555	1,662,475
<b>May:</b>							
Chicago.....	863,854	270,626	121,471	23,701	40	-----	1,279,692
Chicago Open Board.....	28,619	4,389	673	-----	-----	-----	33,681
Minneapolis.....	27,784	694	12,579	1,383	800	423	43,663
Kansas City.....	30,371	9,907	686	-----	-----	-----	40,964
Duluth.....	8,670	-----	-----	3,207	-----	753	12,630
St. Louis.....	9,430	3,142	570	-----	-----	-----	13,142
Milwaukee.....	2,606	1,840	801	99	-----	-----	5,346
Total.....	971,334	290,598	136,780	28,390	840	1,176	1,429,118
<b>June:</b>							
Chicago.....	972,024	374,907	183,024	24,951	40	-----	1,554,946
Chicago Open Board.....	31,636	5,672	1,077	-----	-----	-----	38,385
Minneapolis.....	31,749	995	20,041	1,791	1,462	460	56,498
Kansas City.....	29,149	15,146	1,281	-----	-----	-----	45,576
Duluth.....	10,029	-----	-----	3,094	-----	1,052	14,175
St. Louis.....	10,291	2,855	90	-----	-----	-----	13,236
Milwaukee.....	2,311	2,159	1,351	172	-----	-----	5,993
Total.....	1,087,189	401,734	206,864	30,008	1,502	1,512	1,728,809
<b>July:</b>							
Chicago.....	756,893	332,352	108,276	28,594	35	-----	1,226,150
Chicago Open Board.....	26,431	5,558	740	-----	-----	-----	32,729
Minneapolis.....	32,406	511	8,482	2,137	887	371	44,794
Kansas City.....	23,774	15,736	295	-----	-----	-----	39,805
Duluth.....	9,467	-----	-----	7,005	-----	1,092	17,474
St. Louis.....	8,662	2,626	430	-----	-----	-----	11,718
Milwaukee.....	1,891	1,702	843	178	-----	-----	4,614
Total.....	859,524	358,485	119,066	37,914	922	1,373	1,377,284
<b>August:</b>							
Chicago.....	850,742	382,501	125,763	39,210	98	-----	1,398,314
Chicago Open Board.....	25,975	8,108	725	-----	-----	-----	34,808
Minneapolis.....	47,136	286	17,315	3,064	1,883	907	70,591
Kansas City.....	26,882	19,383	516	-----	-----	-----	46,781
Duluth.....	17,382	-----	-----	19,008	-----	1,839	38,229
St. Louis.....	8,256	3,206	35	-----	-----	-----	11,497
Milwaukee.....	1,673	1,236	781	180	1	-----	3,871
Total.....	978,046	414,720	145,135	61,462	1,982	2,746	1,604,091
<b>September:</b>							
Chicago.....	699,472	350,209	117,850	36,218	21	-----	1,203,770
Chicago Open Board.....	25,514	7,273	659	-----	-----	-----	33,446
Minneapolis.....	44,574	198	13,202	2,922	1,817	1,152	63,865
Kansas City.....	23,483	13,594	311	-----	-----	-----	37,388
Duluth.....	36,481	-----	-----	17,670	-----	2,880	57,031
St. Louis.....	6,971	3,124	60	-----	-----	-----	10,155
Milwaukee.....	1,903	1,190	715	164	1	-----	3,973
Total.....	838,398	375,588	132,797	56,974	1,839	4,032	1,409,628

TABLE 37.—*Grain futures: Volume of trading at seven markets, by markets, by months and by grains, for the period January, 1921, to June, 1924—Continued*

(In thousands of bushels, i. e., 000 omitted)

Months and markets	Wheat futures	Corn futures	Oats futures	Rye futures	Barley futures	Flax futures	All grain futures
1922							
October:							
Chicago.....	667, 542	462, 055	119, 276	38, 710	15		1, 287, 598
Chicago Open Board.....	27, 069	9, 477	906				37, 452
Minneapolis.....	49, 629	175	17, 560	5, 699	1, 950	1, 307	76, 320
Kansas City.....	26, 141	14, 976	222				41, 339
Duluth.....	32, 366			12, 918		3, 923	49, 207
St. Louis.....	8, 052	6, 058	60				14, 170
Milwaukee.....	1, 652	1, 737	858	308			4, 555
Total.....	812, 451	494, 478	138, 882	57, 635	1, 965	5, 230	1, 510, 641
November:							
Chicago.....	722, 831	424, 094	80, 861	55, 178	55		1, 283, 019
Chicago Open Board.....	27, 572	9, 128	704	2			37, 406
Minneapolis.....	52, 253	145	13, 320	8, 464	2, 291	794	77, 267
Kansas City.....	24, 935	13, 833	134				38, 902
Duluth.....	26, 942			13, 149		2, 895	42, 986
St. Louis.....	8, 632	7, 238	95				15, 965
Milwaukee.....	1, 818	2, 389	824	489	3		5, 523
Total.....	864, 983	456, 827	95, 938	77, 282	2, 349	3, 689	1, 501, 068
December:							
Chicago.....	899, 418	433, 902	128, 531	40, 537	130		1, 502, 518
Chicago Open Board.....	32, 629	8, 940	1, 270	2			42, 841
Minneapolis.....	54, 849	112	14, 439	7, 561	1, 436	829	79, 226
Kansas City.....	18, 943	13, 324	402				45, 669
Duluth.....	31, 164			9, 178		1, 599	28, 941
St. Louis.....	12, 467	7, 306	40				19, 813
Milwaukee.....	3, 201	2, 449	892	404	1		6, 947
Total.....	1, 052, 671	466, 033	145, 574	57, 682	1, 567	2, 428	1, 725, 955
1923							
January:							
Chicago.....	820, 938	367, 927	70, 255	27, 790			1, 286, 910
Chicago Open Board.....	31, 993	9, 455	517				41, 965
Minneapolis.....	46, 692	92	7, 746	5, 871	947	383	61, 731
Kansas City.....	28, 468	10, 067	145				38, 680
Duluth.....	11, 757			5, 281		920	17, 958
St. Louis.....	8, 977	5, 578	175				14, 730
Milwaukee.....	2, 368	2, 070	818	186			5, 442
Total.....	951, 193	395, 189	79, 656	39, 128	947	1, 303	1, 467, 416
February:							
Chicago.....	715, 536	388, 853	83, 589	13, 754			1, 201, 732
Chicago Open Board.....	25, 460	8, 068	676				34, 204
Minneapolis.....	32, 445	86	8, 047	3, 724	789	328	45, 419
Kansas City.....	25, 073	8, 213	88				33, 374
Duluth.....	7, 208			3, 113		650	10, 971
St. Louis.....	6, 326	3, 448	210				9, 984
Milwaukee.....	2, 046	2, 052	851	120			5, 069
Total.....	814, 094	410, 720	93, 461	20, 711	789	978	1, 340, 753
March:							
Chicago.....	630, 883	279, 417	52, 820	18, 906			982, 026
Chicago Open Board.....	24, 265	6, 314	392				30, 971
Minneapolis.....	35, 530	70	7, 430	4, 323	621	229	46, 003
Kansas City.....	21, 125	8, 908	74				30, 107
Duluth.....	9, 791			3, 534		667	13, 992
St. Louis.....	5, 298	2, 729					8, 027
Milwaukee.....	1, 906	1, 240	331	139			3, 616
Total.....	726, 598	298, 678	61, 047	26, 902	621	896	1, 114, 742
April:							
Chicago.....	1, 027, 873	513, 551	89, 469	34, 866	55		1, 665, 814
Chicago Open Board.....	35, 454	6, 339	430	10			42, 233
Minneapolis.....	62, 531	148	14, 153	10, 746	1, 582	491	89, 661
Kansas City.....	42, 642	14, 823	367				57, 832
Duluth.....	20, 515			13, 770		1, 079	35, 364
St. Louis.....	7, 865	4, 647	120				12, 632
Milwaukee.....	3, 003	2, 399	1, 086	239			6, 727
Total.....	1, 199, 883	541, 917	105, 625	59, 631	1, 637	1, 570	1, 910, 263



TABLE 37.—*Grain futures: Volume of trading at seven markets, by markets, by months and by grains, for the period January, 1921, to June, 1924—Continued*

[In thousands of bushels, i. e., 000 omitted]

Months and markets	Wheat futures	Corn futures	Oats futures	Rye futures	Barley futures	Flax futures	All grain futures
1923							
May:							
Chicago	925, 292	509, 893	91, 579	34, 181			1, 560, 945
Chicago Open Board	36, 679	11, 574	316	5			48, 574
Minneapolis	46, 364	37	8, 322	6, 138	630	318	61, 809
Kansas City	31, 579	20, 760	135				52, 474
Duluth	16, 316			5, 166		968	22, 450
St. Louis	7, 111	4, 426	120				11, 657
Milwaukee	2, 376	2, 201	610	228			5, 415
Total	1, 065, 717	548, 891	101, 082	45, 718	630	1, 286	1, 763, 324
June:							
Chicago	907, 806	386, 579	57, 803	35, 102	30		1, 387, 320
Chicago Open Board	35, 126	9, 886	341				45, 353
Minneapolis	53, 187	27	7, 459	13, 122	812	491	75, 098
Kansas City	34, 383	14, 924	46				49, 353
Duluth	19, 672			10, 956		821	31, 449
St. Louis	9, 831	3, 515					13, 346
Milwaukee	2, 324	1, 694	398	249			4, 665
Total	1, 062, 329	416, 625	66, 047	59, 429	842	1, 312	1, 606, 584
July:							
Chicago	693, 335	296, 013	55, 577	17, 817	35		1, 062, 777
Chicago Open Board	21, 353	9, 446	448	20			31, 267
Minneapolis	39, 772	3	5, 136	4, 275	966	764	50, 916
Kansas City	27, 393	15, 500	110				43, 003
Duluth	14, 754			3, 025		1, 237	18, 016
St. Louis	9, 500	4, 090					13, 590
Milwaukee	1, 941	1, 354	880	149			4, 324
Total	807, 048	326, 406	62, 151	25, 286	1, 001	2, 001	1, 223, 893
August:							
Chicago	643, 278	255, 320	69, 113	18, 917	50		986, 678
Chicago Open Board	22, 043	7, 538	484	2			30, 067
Minneapolis	48, 818		7, 446	12, 954	1, 397	1, 407	72, 022
Kansas City	41, 553	13, 512	430				55, 495
Duluth	19, 700			9, 949		1, 839	31, 488
St. Louis	7, 488	3, 117					10, 605
Milwaukee	1, 638	1, 208	1, 002	342			4, 190
Total	784, 518	280, 695	78, 475	42, 164	1, 447	3, 246	1, 190, 545
September:							
Chicago	554, 720	276, 867	67, 621	27, 620	95		926, 923
Chicago Open Board	22, 485	9, 246	290	22			32, 043
Minneapolis	44, 497		6, 665	6, 915	1, 405	2, 745	62, 227
Kansas City	29, 435	15, 156	340				44, 931
Duluth	22, 271			7, 543		4, 769	34, 583
St. Louis	4, 733	3, 555					8, 288
Milwaukee	1, 193	1, 132	1, 163	325			3, 813
Total	679, 334	305, 956	76, 079	42, 425	1, 500	7, 514	1, 112, 808
October:							
Chicago	657, 721	402, 503	60, 597	19, 884			1, 140, 705
Chicago Open Board	29, 602	13, 846	213	17			43, 678
Minneapolis	49, 996		7, 857	7, 169	951	2, 625	68, 598
Kansas City	23, 642	18, 909	138				42, 689
Duluth	16, 823			5, 484		6, 569	28, 876
St. Louis	5, 878	8, 013					13, 891
Milwaukee	1, 319	1, 306	843	272			3, 740
Total	784, 981	444, 577	69, 648	32, 826	951	9, 194	1, 342, 177
November:							
Chicago	553, 850	355, 588	40, 414	18, 381			968, 233
Chicago Open Board	24, 314	12, 440	234	5			36, 993
Minneapolis	52, 783		7, 361	13, 226	1, 123	1, 373	75, 866
Kansas City	20, 888	19, 445	275				40, 608
Duluth	19, 084			10, 543		4, 667	34, 294
St. Louis	5, 683	5, 669					11, 352
Milwaukee	1, 099	1, 375	661	404			3, 539
Total	677, 701	394, 517	48, 945	42, 559	1, 123	6, 040	1, 170, 885

TABLE 37.—*Grain futures: Volume of trading at seven markets, by markets, by months and by grains, for the period January, 1921, to June, 1924—Continued*

[In thousands of bushels, i. e., 000 omitted]

Months and markets	Wheat futures	Corn futures	Oats futures	Rye futures	Barley futures	Flax futures	All grain futures
1923							
December:							
Chicago	440, 879	254, 326	49, 466	15, 817			760, 488
Chicago Open Board	19, 678	7, 686	403	22			27, 789
Minneapolis	34, 185		4, 667	4, 985	558	1, 125	45, 520
Kansas City	20, 988	15, 888	227				37, 103
Duluth	7, 509			5, 891		2, 383	15, 783
St. Louis	4, 497	5, 365					9, 862
Milwaukee	1, 152	1, 619	627	334			3, 732
Total	528, 888	284, 884	55, 390	27, 049	558	3, 508	900, 277
1924							
January:							
Chicago	308, 534	415, 449	63, 156	8, 478			795, 617
Chicago Open Board	17, 657	14, 986	948				33, 591
Minneapolis	23, 875		5, 308	2, 977	319	695	33, 174
Kansas City	13, 179	19, 131	41				32, 351
Duluth	5, 595			2, 879		1, 051	9, 525
St. Louis	3, 088	5, 949					9, 037
Milwaukee	733	1, 395	832	235			3, 195
Total	372, 661	456, 910	70, 285	14, 569	319	1, 746	916, 490
February:							
Chicago	348, 099	306, 626	44, 443	8, 136			707, 304
Chicago Open Board	20, 721	12, 662	653	1			34, 037
Minneapolis	24, 423		4, 257	2, 562	279	562	32, 083
Kansas City	12, 239	12, 427	28				24, 694
Duluth	6, 219			2, 236		892	9, 347
St. Louis	4, 605	4, 917					9, 522
Milwaukee	808	1, 218	559	106			2, 691
Total	417, 114	337, 850	49, 940	13, 041	279	1, 454	819, 678
March:							
Chicago	505, 598	406, 849	66, 631	17, 167			996, 245
Chicago Open Board	24, 284	14, 400	1, 065	24			39, 773
Minneapolis	31, 855		5, 425	7, 248	461	572	45, 561
Kansas City	17, 525	13, 285	28				30, 838
Duluth	8, 493			3, 735		1, 269	13, 497
St. Louis	4, 483	5, 588					10, 071
Milwaukee	1, 012	1, 638	671	210			3, 531
Total	593, 250	441, 760	73, 820	28, 384	461	1, 841	1, 139, 516
April:							
Chicago	364, 932	295, 807	47, 741	21, 706			730, 186
Chicago Open Board	19, 175	10, 362	1, 035	2			30, 574
Minneapolis	31, 893		5, 932	12, 915	439	508	51, 687
Kansas City	22, 001	12, 092	115				34, 208
Duluth	8, 804			14, 951		1, 245	25, 000
St. Louis	3, 797	3, 678					7, 475
Milwaukee	584	1, 304	445	631			2, 964
Total	451, 186	323, 243	55, 268	50, 205	439	1, 753	882, 094
May:							
Chicago	318, 850	265, 567	37, 579	14, 802			636, 798
Chicago Open Board	14, 233	7, 693	540	10			22, 476
Minneapolis	17, 372		3, 179	4, 987	231	378	26, 147
Kansas City	13, 295	10, 795	117				24, 207
Duluth	6, 269			5, 002		1, 001	12, 272
St. Louis	3, 158	2, 738					5, 896
Milwaukee	699	1, 201	247	68			2, 215
Total	373, 876	287, 994	41, 662	24, 869	231	1, 379	730, 011
June:							
Chicago	734, 527	394, 376	84, 166	47, 575			1, 260, 644
Chicago Open Board	26, 229	10, 315	860				37, 404
Minneapolis	41, 211		3, 844	13, 417	209	352	59, 033
Kansas City	28, 709	16, 555	194				45, 458
Duluth	9, 144			14, 026		614	23, 784
St. Louis	8, 863	3, 232					12, 095
Milwaukee	1, 372	1, 842	371	389			3, 974
Total	850, 055	426, 320	89, 435	75, 407	209	966	1, 442, 392

TABLE 38.—*Grain futures: Volume of trading, by futures, during the "life" of the future, for each of the principal grains, Chicago Board of Trade, for futures expiring July, 1921, to June, 1924*

Grain and year	Volume of trading, in thousands of bushels, i. e., 000 omitted					
	July future	Septem- ber future	Decem- ber future	May future	Other futures expiring during year	All futures expiring during year
Wheat:						
1921.....	2, 220, 351	1, 499, 096	2, 324, 822		332	6, 044, 601
1922.....	2, 695, 392	1, 383, 957	1, 720, 916	6, 075, 842	5, 248	11, 881, 355
1923.....	2, 470, 696	1, 550, 345	1, 746, 958	3, 704, 517	1, 352	9, 473, 868
1924.....				2, 037, 720	516	2, 038, 236
3-year average.....	2, 462, 146	1, 477, 799	1, 930, 899	3, 939, 360	2, 483	9, 812, 687
Per cent.....	25. 09	15. 06	19. 68	40. 15	. 025	100. 00
Corn:						
1921.....	1, 436, 777	1, 179, 337	804, 613		324	3, 421, 051
1922.....	771, 657	638, 235	1, 135, 402	1, 626, 666	2, 724	4, 174, 684
1923.....	1, 010, 157	722, 559	952, 758	1, 887, 005	3, 364	4, 575, 843
1924.....				1, 629, 643	2, 091	1, 631, 734
Average.....	1, 072, 864	846, 710	964, 258	1, 714, 438	2, 834	4, 601, 104
Per cent.....	23. 32	18. 40	20. 96	37. 26	. 06	100. 00
Oats:						
1921.....	378, 424	715, 862	573, 486		103	1, 667, 876
1922.....	333, 845	255, 996	271, 003	816, 447	1, 297	1, 678, 588
1923.....	174, 806	150, 346	147, 795	480, 653	775	954, 375
1924.....				303, 562	415	303, 977
Average.....	295, 692	374, 068	330, 761	533, 554	863	1, 534, 938
Per cent.....	19. 26	24. 37	21. 55	34. 76	. 06	100. 00
Rye:						
1921.....	49, 896	31, 322	46, 410		15	127, 643
1922.....	37, 185	72, 428	70, 719	88, 322	174	268, 828
1923.....	65, 170	40, 960	54, 424	184, 527	115	345, 196
1924.....				88, 054	300	88, 354
Average.....	50, 750	48, 237	57, 184	120, 301	201	276, 674
Per cent.....	18. 54	17. 44	20. 67	43. 48	. 07	100. 00
Barley:						
1921.....	352	506	976		0	1, 834
1922.....	10	117	252	280	0	659
1923.....	0	190	0	75	0	265
1924.....				20	0	20
Average.....	121	271	409	125	0	926
Per cent.....	13. 07	29. 26	44. 17	13. 50	0	100. 00



TABLE 39.—Wheat futures: Volume of trading in each of the principal futures, by months, Chicago Board of Trade, for the period July 1, 1921, to June 30, 1924

Month	Volume of trading, in thousands of bushels, i e. 000 omitted					
	July wheat	September wheat	December wheat	May wheat	Other wheat futures	Total
<b>1921</b>						
July.....	124, 215	643, 762	191, 547	—	80	959, 604
August.....	—	390, 262	495, 779	20, 678	45	906, 764
September.....	—	45, 014	770, 428	402, 817	—	1, 218, 259
October.....	—	—	569, 800	587, 301	202	1, 157, 303
November.....	145	—	256, 008	853, 788	5	1, 109, 946
December.....	144, 079	—	41, 260	801, 456	—	986, 795
<b>1922</b>						
January.....	169, 374	—	—	629, 891	41	799, 306
February.....	380, 037	—	—	941, 574	796	1, 322, 407
March.....	368, 838	21, 049	—	1, 087, 215	10	1, 477, 112
April.....	363, 787	50, 157	—	626, 974	26	1, 040, 944
May.....	626, 295	111, 980	—	124, 148	1, 431	863, 854
June.....	588, 159	324, 699	56, 407	—	2, 759	972, 024
July.....	54, 678	526, 014	176, 201	—	—	756, 893
August.....	—	308, 791	430, 491	111, 045	55	850, 742
September.....	—	41, 267	446, 060	212, 115	30	699, 472
October.....	39, 891	—	378, 385	249, 166	100	667, 542
November.....	68, 647	—	182, 137	451, 047	—	722, 831
December.....	201, 858	—	51, 235	646, 325	—	899, 418
<b>1923</b>						
January.....	154, 484	14, 693	—	651, 641	120	820, 938
February.....	147, 659	25, 121	—	542, 609	147	715, 536
March.....	143, 221	26, 660	—	460, 992	10	630, 883
April.....	535, 248	171, 153	—	321, 472	—	1, 027, 873
May.....	639, 426	227, 671	450	57, 745	—	925, 292
June.....	473, 629	356, 441	77, 697	—	39	907, 806
July.....	45, 633	433, 900	200, 165	13, 627	10	693, 335
August.....	10	253, 057	299, 003	91, 208	—	643, 278
September.....	3, 195	41, 649	366, 432	143, 444	—	554, 720
October.....	18, 432	—	442, 227	196, 767	295	657, 721
November.....	26, 300	—	315, 581	211, 228	741	553, 850
December.....	45, 247	—	45, 403	350, 229	—	440, 879
<b>1924</b>						
January.....	56, 695	10, 323	—	241, 502	14	308, 534
February.....	79, 546	39, 970	—	228, 583	—	348, 099
March.....	112, 774	62, 381	—	330, 443	—	505, 598
April.....	127, 670	46, 467	888	189, 907	—	364, 932
May.....	202, 482	69, 487	6, 099	40, 782	—	318, 850
June.....	215, 517	413, 066	105, 412	30	502	734, 527

TABLE 40.—*Corn futures: Volume of trading in each of the principal futures, by months, Chicago Board of Trade, for the period July 1, 1921, to June 30, 1924*

Month	Volume of trading, in thousands of bushels, i. e., 000 omitted					
	December corn	May corn	July corn	September corn	Other corn futures	Total
<b>1921</b>						
July	107, 630		47, 572	342, 176		497, 378
August	175, 701	4, 714		225, 441	115	405, 971
September	224, 215	62, 215		48, 030	35	334, 495
October	153, 215	108, 716			147	262, 078
November	95, 431	176, 148			27	271, 606
December	38, 883	210, 111	10, 914			259, 908
<b>1922</b>						
January		147, 813	13, 805		236	161, 854
February		399, 650	93, 386	5, 648	701	499, 385
March		374, 825	145, 415	16, 930	10	537, 180
April		114, 544	140, 841	22, 233		277, 618
May		27, 930	196, 125	46, 571		270, 626
June	65, 426		144, 548	164, 493	440	374, 907
July	102, 461		26, 623	203, 258	10	332, 352
August	198, 196	49, 528		134, 766	11	382, 501
September	223, 857	81, 866		44, 336	150	350, 209
October	310, 815	133, 850	16, 454		936	462, 055
November	174, 999	223, 251	25, 599		245	424, 094
December	59, 648	327, 853	46, 329		72	433, 902
<b>1923</b>						
January		313, 233	49, 686	4, 768	240	367, 927
February		309, 554	62, 877	16, 402	20	388, 853
March		208, 550	51, 594	19, 263	10	279, 417
April	475	202, 253	245, 242	65, 561	20	513, 551
May	2, 549	37, 067	331, 362	138, 915		509, 893
June	45, 360		153, 573	187, 621	25	386, 579
July	103, 736	5, 259	27, 441	159, 571	6	296, 013
August	122, 967	32, 013		100, 020	320	255, 320
September	175, 467	69, 469	541	30, 438	952	276, 867
October	257, 186	127, 709	16, 064		1, 544	402, 503
November	188, 247	148, 029	18, 982	20	310	355, 588
December	56, 771	173, 415	23, 643	71	426	254, 326
<b>1924</b>						
January		333, 602	60, 422	20, 567	858	415, 449
February		240, 006	44, 541	22, 079		306, 626
March		279, 679	81, 404	45, 746	20	406, 849
April	90	174, 793	75, 480	45, 439	5	295, 807
May	3, 621	45, 669	121, 009	95, 268		265, 567
June	127, 994	20	105, 654	160, 096	612	394, 376

TABLE 41.—Oats futures: Volume of trading in each of the principal futures, by months, Chicago Board of Trade, for the period July 1, 1921, to June 30, 1924

Month	Volume of trading, in thousands of bushels, i. e., 000 omitted					
	September oats	December oats	May oats	July oats	Other oats futures	Total
1921						
July.....	172, 240	60, 246		13, 574		246, 060
August.....	97, 930	142, 566	10, 999		20	251, 515
September.....	16, 933	149, 345	75, 725			242, 003
October.....		118, 651	101, 937			220, 588
November.....		68, 478	104, 885	480	83	173, 926
December.....		26, 943	102, 352	8, 724		138, 019
1922						
January.....			65, 266	11, 717	217	77, 200
February.....			140, 369	37, 082	190	180, 796
March.....			122, 179	52, 348	45	182, 845
April.....	13, 834		63, 640	56, 534	22	134, 030
May.....	22, 978		29, 095	69, 398		121, 471
June.....	77, 163	25, 369		79, 899	593	183, 024
July.....	57, 269	33, 339		17, 663	5	108, 276
August.....	49, 705	49, 067	26, 851		140	125, 763
September.....	23, 619	57, 604	36, 592		35	117, 850
October.....		60, 123	52, 151	6, 957	45	119, 276
November.....		25, 669	48, 404	6, 783	5	80, 861
December.....		19, 832	97, 455	11, 129	115	128, 531
1923						
January.....	393		60, 894	8, 603	365	70, 255
February.....	3, 184		62, 276	18, 029	100	83, 589
March.....	4, 043		36, 581	12, 066	130	52, 820
April.....	18, 323		36, 004	35, 142		89, 469
May.....	29, 312	130	23, 445	38, 692		91, 579
June.....	24, 619	8, 720		24, 364	100	57, 803
July.....	26, 574	14, 535	1, 422	13, 041	5	55, 577
August.....	30, 130	25, 066	13, 902		15	69, 113
September.....	13, 768	34, 757	19, 046	20	30	67, 621
October.....		36, 184	23, 634	744	35	60, 597
November.....		16, 799	22, 300	1, 315		40, 414
December.....		11, 604	34, 133	3, 729		49, 466
1924						
January.....	1, 127		55, 803	6, 071	155	63, 156
February.....	1, 295		36, 593	6, 545	10	44, 443
March.....	5, 310		47, 861	13, 425	35	66, 631
April.....	5, 465		30, 010	12, 206	60	47, 741
May.....	6, 174	305	18, 858	12, 242		37, 579
June.....	45, 468	10, 794		27, 749	155	84, 166



TABLE 42.—*Rye futures: Volume of trading in each of the principal futures, by months, Chicago Board of Trade, for the period July 1, 1921, to June 30, 1924*

Month	Volume of trading, in thousands of bushels, i. e., 000 omitted					
	July rye	September rye	December rye	May rye	Other rye futures	Total
<b>1921</b>						
July.....	9,548	7,141	597	-----	-----	17,286
August.....	-----	12,415	4,851	85	15	17,366
September.....	-----	4,127	12,024	912	-----	17,063
October.....	-----	-----	15,127	2,273	-----	17,400
November.....	-----	-----	9,228	7,138	-----	16,366
December.....	15	-----	4,583	7,692	-----	12,290
<b>1922</b>						
January.....	70	-----	-----	4,666	10	4,746
February.....	1,562	-----	-----	22,731	101	24,394
March.....	1,099	-----	-----	17,356	2	18,457
April.....	2,967	288	-----	15,269	10	18,534
May.....	11,715	1,786	-----	10,200	-----	23,701
June.....	15,326	9,282	292	-----	51	24,951
July.....	4,468	21,285	2,841	-----	-----	28,594
August.....	-----	27,514	10,916	780	-----	39,210
September.....	-----	12,273	21,663	2,282	-----	36,218
October.....	5	-----	21,358	17,347	-----	38,710
November.....	-----	-----	11,238	43,940	-----	55,178
December.....	-----	-----	2,411	38,126	-----	40,537
<b>1923</b>						
January.....	156	-----	-----	27,634	-----	27,790
February.....	533	-----	-----	13,221	-----	13,754
March.....	4,430	94	-----	14,382	-----	18,906
April.....	14,349	1,525	-----	18,992	-----	34,866
May.....	22,393	3,965	-----	7,823	-----	34,181
June.....	18,659	14,644	1,799	-----	-----	35,102
July.....	4,645	9,024	3,766	382	-----	17,817
August.....	-----	6,852	8,832	3,158	75	18,917
September.....	-----	4,856	16,656	6,108	-----	27,620
October.....	34	-----	10,004	9,816	30	19,884
November.....	44	-----	9,426	8,901	10	18,381
December.....	47	10	3,941	11,819	-----	15,817
<b>1924</b>						
January.....	329	-----	-----	8,125	24	8,478
February.....	1,036	2	-----	7,093	5	8,136
March.....	2,668	179	-----	14,320	-----	17,167
April.....	6,596	1,005	-----	14,105	-----	21,706
May.....	8,974	1,576	25	4,227	-----	14,802
June.....	15,147	27,875	4,282	-----	271	47,575

TABLE 43.—*Barley futures: Volume of trading in each of the principal futures by months, Chicago Board of Trade, for the period July 1, 1921, to June 30, 1924*

Month	Volume of trading, in thousands of bushels; i. e., 000 omitted				
	September barley	December barley	May bar- ley	July bar- ley	Total
1921					
July.....	113			97	210
August.....	249	298			547
September.....	134	176			310
October.....		253			253
November.....		218	50		268
December.....		31	75		106
1922					
January.....			45		45
February.....			40		40
March.....			20		20
April.....			15		15
May.....			35		40
June.....	40			5	40
July.....	30			5	35
August.....	41	57			98
September.....	6	15			21
October.....		10	5		15
November.....		55			55
December.....		115	15		130
1923					
January.....					
February.....					
March.....					
April.....					
May.....			55		55
June.....	30				30
July.....	35				35
August.....	50				50
September.....	75		20		95
October.....					
November.....					
December.....					
1924					
January.....					
February.....					
March.....					
April.....					
May.....					
June.....					

TABLE 44.—Wheat futures: Volume of trading in each of the principal futures, by weeks, Chicago Board of Trade, for the year July 1, 1923, to June 30, 1924

Week ended—		In thousands of bushels, i. e., 000 omitted					
		December future	July future	September future	May future	Other futures	All futures
1923							
July	7	20,121	9,925	59,453	30		89,529
	14	41,143	10,653	102,989	122		154,907
	21	62,968	7,766	119,309	3,925	5	193,973
	28	57,062	10,338	114,769	6,985	5	189,158
Aug.	4	38,705	6,951	77,642	7,231		130,529
	11	33,545		53,511	8,946		96,002
	18	65,992		77,063	21,850		164,905
	25	81,254		42,401	24,295		147,930
Sept.	1	113,400	10	46,109	36,452		195,971
	8	77,918	30	13,108	29,644		120,700
	15	104,749	20	6,900	43,099		154,768
	22	79,524	1,096	5,032	32,818		118,470
	29	89,239	2,049	10,320	32,882		134,490
Oct.	6	134,054	4,323		50,390	110	188,877
	13	96,663	5,147		40,987	115	142,912
	20	98,429	4,030		47,442	25	149,926
	27	80,272	3,285		38,380	30	121,967
Nov.	3	62,803	3,483		34,537	65	100,888
	10	90,017	5,251		45,201		140,469
	17	87,141	5,775		58,950	445	152,311
	24	73,304	8,223		47,680	245	129,452
Dec.	1	40,859	7,283		60,924	1	109,067
	8	15,093	11,774		112,955		139,822
	15	6,746	7,553		65,441		79,740
	22	8,069	11,509		75,882		95,460
	29	6,870	9,929		65,600		82,399
1924							
Jan.	5	2,891	14,168	1,046	53,522	4	71,631
	12		13,870	2,396	55,359	10	71,635
	19		10,628	2,236	62,784		75,648
	26		6,988	774	36,487		44,249
Feb.	2		23,320	7,738	69,735		100,793
	9		24,121	9,790	58,211		92,122
	16		23,363	13,378	68,568		105,309
	23		12,810	7,136	44,549		64,495
Mar.	1		11,541	6,683	41,578		59,802
	8		15,991	11,630	41,594		69,215
	15		39,200	18,808	108,432		166,440
	22		20,817	10,077	69,364		100,258
	29		31,231	19,431	97,362		148,024
Apr.	5	101	22,124	9,700	52,783		84,708
	12	75	14,363	7,495	43,493		65,426
	19	160	22,822	9,166	38,603		70,751
	26	227	42,430	14,390	29,549		86,596
May	3	655	62,850	15,631	52,499		131,635
	10	908	48,075	12,547	7,172		69,702
	17	996	34,830	10,552	3,715		50,093
	24	1,367	45,668	16,735	3,358		67,128
	31	2,498	39,371	21,289	6,355		69,513
June	7	5,544	68,157	44,262		134	118,097
	14	19,705	76,133	84,657		262	180,757
	21	35,227	48,047	146,512		86	229,872
	28	38,425	18,045	117,532		20	174,022



TABLE 45.—*Grain futures: "Customers'" open interests (one side only), Chicago Board of Trade, by grains and for all grains combined, at monthly intervals during the period July to December, 1923*

[In thousands of bushels, i. e., 000 omitted]

Grain	"Customers'" open interests	Grain	"Customers'" open interests	Grain	"Customers'" open interests
July 31, 1923:		Sept. 29, 1923:		Nov. 30, 1923:	
Wheat futures.....	89,855	Wheat futures.....	89,603	Wheat futures.....	92,646
Corn futures.....	40,366	Corn futures.....	41,532	Corn futures.....	60,780
Oats futures.....	16,830	Oats futures.....	23,323	Oats futures.....	24,602
Rye futures.....	8,293	Rye futures.....	10,256	Rye futures.....	11,763
Barley futures.....	60	Barley futures.....	(1)	Barley futures.....	(1)
Total.....	155,404	Total.....	164,714	Total.....	189,791
Aug. 31, 1923:		Oct. 31, 1923:		Dec. 31, 1923:	
Wheat futures.....	95,910	Wheat futures.....	93,634	Wheat futures.....	95,395
Corn futures.....	38,390	Corn futures.....	59,757	Corn futures.....	54,423
Oats futures.....	22,628	Oats futures.....	26,180	Oats futures.....	24,169
Rye futures.....	10,021	Rye futures.....	12,232	Rye futures.....	11,274
Barley futures.....	45	Barley futures.....	(1)	Barley futures.....	(1)
Total.....	166,994	Total.....	191,803	Total.....	185,261

<sup>1</sup> No trading.

TABLE 46.—*Grain futures: "Customers'" open interests (one side only), for six markets, by markets, by months, and by grains, with totals for all grains, at monthly intervals during the period January to June, 1924*

Grain	“Customers’ ” open interests, in thousands of bushels, i. e., 000 omitted						
	Chicago	Minneapolis	Duluth	Kansas City	St. Louis	Milwaukee	Total
January 31, 1924:							
Wheat futures.....	95, 479	15, 955	4, 616	11, 289	2, 342	233	129, 914
Corn futures.....	66, 319	(1)	(1)	6, 578	1, 985	451	75, 333
Oats futures.....	25, 960	3, 420	(1)	50	(1)	336	29, 766
Rye futures.....	11, 363	6, 690	5, 961	(1)	(1)	387	24, 401
Barley futures.....	(1)	271	(1)	(1)	(1)	(1)	271
Flax futures.....	(1)	376	847	(1)	(1)	(1)	1, 223
Total.....	199, 121	26, 712	11, 424	17, 917	4, 327	1, 407	260, 908
Feb. 29, 1924:							
Wheat futures.....	106, 903	15, 220	4, 115	10, 832	2, 171	313	139, 554
Corn futures.....	76, 679	(1)	(1)	5, 410	2, 197	549	84, 835
Oats futures.....	26, 261	3, 771	(1)	48	(1)	330	30, 410
Rye futures.....	12, 152	6, 993	6, 172	(1)	(1)	386	25, 703
Barley futures.....	(1)	271	(1)	(1)	(1)	(1)	271
Flax futures.....	(1)	339	753	(1)	(1)	(1)	1, 092
Total.....	221, 995	26, 594	11, 040	16, 290	4, 368	1, 578	281, 865
Mar. 31, 1924:							
Wheat futures.....	92, 856	13, 220	3, 352	9, 408	2, 207	308	121, 351
Corn futures.....	79, 833	(1)	(1)	5, 404	1, 994	712	87, 943
Oats futures.....	24, 607	3, 644	(1)	67	(1)	269	28, 587
Rye futures.....	11, 276	7, 195	6, 830	(1)	(1)	389	25, 690
Barley futures.....	(1)	226	(1)	(1)	(1)	(1)	226
Flax futures.....	(1)	247	707	(1)	(1)	(1)	954
Total.....	208, 572	24, 532	10, 889	14, 879	4, 201	1, 678	264, 751
Apr. 30, 1924:							
Wheat futures.....	74, 602	11, 208	2, 759	8, 264	1, 585	221	98, 639
Corn futures.....	67, 461	(1)	(1)	4, 233	1, 502	653	73, 849
Oats futures.....	19, 043	2, 352	(1)	89	(1)	194	21, 678
Rye futures.....	8, 318	8, 572	5, 596	(1)	(1)	313	22, 799
Barley futures.....	(1)	168	(1)	(1)	(1)	(1)	168
Flax futures.....	(1)	202	899	(1)	(1)	(1)	1, 101
Total.....	169, 424	22, 502	9, 254	12, 586	3, 087	1, 381	218, 234

<sup>1</sup> No trading.

TABLE 46.—Grain futures: "Customers'" open interests (one side only), for six markets, by markets, by months, and by grains, with totals for all grains, at monthly intervals during the period January to June, 1924—Continued

Grain	"Customers'" open figures, in thousands of bushels, i. e., 000 omitted						
	Chicago	Minneapolis	Duluth	Kansas City	St. Louis	Milwaukee	Total
May 31, 1924:							
Wheat futures.....	65,128	10,178	1,728	5,883	1,389	227	84,533
Corn futures.....	53,146	(1)	(1)	3,696	786	390	58,018
Oats futures.....	12,502	960	(1)	60	(1)	141	13,663
Rye futures.....	6,073	6,100	6,015	(1)	(1)	290	18,478
Barley futures.....	(1)	69	(1)	(1)	(1)	(1)	69
Flax futures.....	(1)	140	251	(1)	(1)	(1)	391
Total.....	136,849	17,447	7,994	9,639	2,175	1,048	175,152
June 30, 1924:							
Wheat futures.....	82,057	11,016	1,373	5,786	1,451	183	101,866
Corn futures.....	44,480	(1)	(1)	2,787	561	331	48,159
Oats futures.....	16,694	1,467	(1)	32	(1)	108	18,301
Rye futures.....	14,823	5,085	5,784	(1)	(1)	63	25,755
Barley futures.....	(1)	105	(1)	(1)	(1)	(1)	105
Flax futures.....	(1)	123	244	(1)	(1)	(1)	367
Total.....	158,054	17,796	7,401	8,605	2,012	685	194,553

<sup>1</sup> No trading.

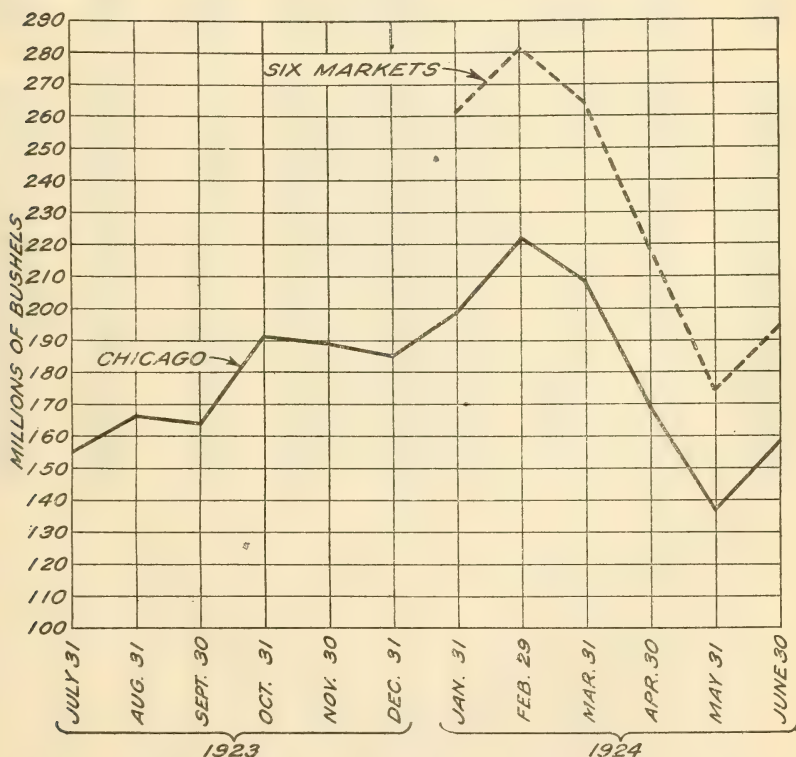


FIG. 8.—"Customers'" open interests in grain futures at monthly intervals for six markets and on the Chicago Board of Trade during varying periods ended June 30, 1924. (Based on Tables 45 and 46.)

TABLE 47.—Wheat futures: "Customers'" open interests (one side only), all futures combined, for 4 principal markets, at weekly intervals, during the period July 1, 1923, to June 30, 1924

["Customers'" open interests, in thousands of bushels, i. e., 000 omitted]

Week ended		Chicago	Minneapolis	Duluth	Kansas City	Total
1923						
July	7	(1)	(1)	(1)	(1)	(1)
	14	76, 283	(1)	(1)	(1)	(1)
	21	84, 663	(1)	(1)	(1)	(1)
	28	95, 381	(1)	(1)	(1)	(1)
Aug.	4	94, 504	9, 551	3, 509	9, 850	117, 414
	11	100, 653	9, 472	4, 070	12, 635	126, 830
	18	104, 054	10, 809	4, 961	12, 882	132, 706
	25	99, 092	11, 086	6, 580	13, 389	130, 147
Sept.	1	91, 576	11, 796	8, 019	12, 123	123, 514
	8	91, 157	12, 587	9, 070	12, 295	125, 109
	15	98, 055	13, 465	9, 372	12, 896	133, 788
	22	99, 632	14, 542	9, 744	12, 553	136, 471
	29	89, 603	14, 873	9, 159	11, 062	124, 697
Oct.	6	85, 046	15, 351	8, 718	10, 709	119, 824
	13	84, 697	16, 089	8, 423	10, 235	119, 444
	20	91, 343	16, 612	8, 064	10, 776	126, 795
	27	92, 722	16, 864	7, 295	10, 833	127, 714
Nov.	3	93, 986	17, 476	7, 079	10, 156	123, 697
	10	100, 153	18, 037	6, 830	10, 236	135, 256
	17	102, 712	17, 772	6, 517	10, 845	137, 846
	24	97, 174	17, 301	6, 419	11, 017	131, 911
Dec.	1	93, 190	16, 291	6, 386	10, 341	126, 208
	8	92, 810	16, 042	5, 956	10, 826	125, 634
	15	95, 719	16, 706	5, 895	11, 380	129, 700
	22	98, 516	16, 773	4, 959	11, 536	131, 784
	29	97, 870	16, 880	4, 727	11, 674	131, 151
1924						
Jan.	5	97, 322	16, 326	4, 734	12, 072	130, 454
	12	96, 973	16, 238	4, 786	11, 834	129, 831
	19	96, 798	16, 273	4, 563	11, 769	129, 403
	26	95, 862	16, 232	4, 541	11, 715	128, 350
Feb.	2	97, 098	15, 810	4, 481	10, 997	125, 386
	9	100, 557	15, 809	4, 494	10, 961	131, 821
	16	104, 689	15, 673	4, 464	10, 850	135, 676
	23	105, 744	15, 294	4, 302	10, 854	136, 194
Mar.	1	106, 527	15, 284	4, 046	10, 805	136, 662
	8	104, 696	14, 763	3, 977	10, 581	134, 017
	15	104, 650	14, 213	3, 759	10, 582	133, 204
	22	101, 831	13, 508	3, 688	10, 433	129, 460
	29	92, 743	13, 319	3, 401	9, 525	118, 988
Apr.	5	93, 570	13, 102	3, 359	9, 171	119, 202
	12	93, 619	12, 802	3, 201	8, 944	118, 566
	19	90, 315	12, 264	2, 951	9, 019	114, 549
	26	87, 533	11, 714	2, 870	8, 780	110, 897
May	3	65, 024	10, 697	2, 482	6, 370	84, 573
	10	66, 576	10, 429	2, 199	6, 350	85, 554
	17	64, 032	10, 276	2, 025	6, 012	82, 345
	24	60, 720	10, 131	1, 772	5, 916	78, 539
	31	65, 128	10, 178	1, 728	5, 883	82, 917
June	7	62, 852	10, 163	1, 699	5, 970	80, 684
	14	67, 041	9, 896	1, 760	5, 924	84, 621
	21	75, 569	10, 436	1, 619	5, 587	93, 211
	28	80, 998	10, 868	1, 281	5, 705	98, 852

<sup>1</sup> Not available.



TABLE 48.—Wheat futures: "Customers'" open interests (one side only), by futures, Chicago Board of Trade, at weekly intervals during the period July 9, 1923, to June 30, 1924

["Customers'" open interests, in thousands of bushels, i. e., 000 omitted]

Week ended	July wheat	September wheat	December wheat	May wheat	Total
<b>1923</b>					
July 14.....	12,952	42,099	21,126	106	76,283
21.....	11,090	45,275	25,616	2,677	84,658
28.....	5,741	49,665	34,149	5,821	95,376
Aug. 4.....	49,823	36,695	36,695	7,986	94,504
11.....	49,479	40,182	40,182	10,992	100,653
18.....	42,832	45,751	45,751	15,471	104,054
25.....	31,992	48,995	48,995	18,105	99,092
Sept. 1.....	11,218	57,717	57,717	22,641	91,576
8.....	7,571	57,964	57,964	25,622	91,157
15.....	10	60,901	60,901	31,445	98,055
22.....	833	4,748	60,417	33,634	99,632
29.....	1,480	53,840	53,840	34,283	89,603
Oct. 6.....	2,536	50,137	50,137	32,353	85,026
13.....	3,034	47,381	47,381	34,282	84,697
20.....	3,844	49,251	49,251	38,248	91,343
27.....	4,767	48,624	48,624	39,331	92,722
Nov. 3.....	5,309	48,029	48,029	40,648	93,986
10.....	6,897	46,711	46,711	46,545	100,153
17.....	8,080	43,220	43,220	51,067	102,367
24.....	10,336	32,253	32,253	54,585	97,174
Dec. 1.....	12,815	17,073	63,302	63,302	93,190
8.....	14,306	12,159	66,345	66,345	92,810
15.....	15,611	9,501	70,607	70,607	95,719
22.....	17,443	5,547	75,526	75,526	98,516
29.....	19,307	2,100	76,463	76,463	97,870
<b>1924</b>					
Jan. 5.....	21,014	596	75,712	75,712	97,322
12.....	21,302	1,507	74,164	74,164	96,973
19.....	21,433	2,203	73,162	73,162	96,798
26.....	21,337	2,265	72,260	72,260	95,862
Feb. 2.....	23,195	4,331	69,572	69,572	97,098
9.....	25,048	6,817	68,692	68,692	100,557
16.....	25,806	9,402	69,481	69,481	104,689
23.....	26,401	9,943	69,400	69,400	105,744
Mar. 1.....	27,125	10,188	69,214	69,214	106,527
8.....	26,845	11,319	66,532	66,532	104,696
15.....	27,164	12,675	64,811	64,811	104,650
22.....	26,170	13,746	61,915	61,915	101,831
29.....	26,097	14,790	51,856	51,856	92,743
Apr. 5.....	27,739	15,452	96	50,283	93,570
12.....	28,628	15,868	106	49,017	93,619
19.....	28,524	16,829	225	44,737	90,315
26.....	33,111	17,538	321	36,563	87,533
May 3.....	38,767	18,220	541	7,496	65,024
10.....	40,145	20,061	747	5,623	66,576
17.....	39,472	19,464	1,260	3,836	64,032
24.....	37,982	18,765	1,882	2,091	60,720
31.....	40,278	21,913	2,897	-----	65,088
June 7.....	35,064	23,752	4,006	-----	62,822
14.....	24,165	35,212	7,604	-----	66,981
21.....	18,562	44,860	12,147	-----	75,569
28.....	13,516	49,444	18,038	-----	80,998

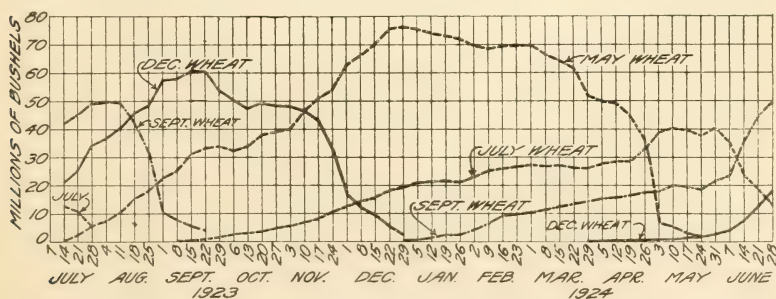


FIG. 9.—"Customers'" open interests in each of the principal wheat futures at weekly intervals Chicago Board of Trade for the year ended June 30, 1924. (Based on Table 48.)

TABLE 49.—Wheat futures: Net position data relating to 45 "hedging" accounts, Chicago Board of Trade, weekly intervals during the calendar year 1923

[In thousands of bushels, i. e., 000 omitted]

Week ended	Number accounts net long	Aggre- gate of net long interests	Number accounts net short	Aggre- gate of net short interests	Total number accounts net long and net short	Difference in net positions	
						Long	Short
1923							
Jan. 6	5	8,519	23	17,487	28		8,968
13	5	3,144	22	16,507	27		13,363
20	4	2,934	23	18,162	27		15,228
27	3	3,064	24	17,407	27		14,343
Feb. 3	5	2,869	24	18,102	29		15,233
10	5	546	24	18,642	29		18,096
17	4	220	24	17,156	28		16,936
24	4	270	23	17,061	23		16,791
Mar. 3	4	695	24	16,276	28		15,581
10	4	1,040	23	16,731	23		15,691
17	5	1,130	25	17,131	30		16,001
24	4	1,200	26	18,981	30		17,781
31	4	750	25	17,876	29		17,126
Apr. 7	9	2,355	23	14,305	32		11,955
14	8	3,925	24	14,452	32		10,527
21	5	2,665	28	13,790	33		11,125
28	7	2,410	26	13,929	33		11,519
May 5	6	815	25	12,541	31		11,726
12	7	1,195	23	12,221	30		11,026
19	7	1,140	24	12,436	31		11,296
26	8	1,225	23	12,361	31		11,136
June 2	9	1,166	22	10,291	31		9,125
9	11	1,666	22	10,018	33		8,352
16	10	1,586	22	9,737	32		8,151
23	13	2,985	19	6,798	32		3,813
30	14	5,055	16	6,654	30		1,599
July 7	16	5,725	16	7,373	32		1,648
14	17	7,660	15	9,358	32		1,698
21	17	7,780	18	13,817	35		6,037
28	19	8,545	18	18,021	37		9,476
Aug. 4	18	7,710	19	21,818	37		14,108
11	18	6,625	20	24,023	38		17,398
18	15	6,610	22	26,094	37		19,484
25	14	6,978	22	26,717	36		19,739
Sept. 1	12	6,228	24	27,064	36		20,836
8	14	5,598	22	26,789	36		21,191
15	14	4,858	23	27,677	37		22,819
22	13	4,272	25	28,122	38		23,850
29	13	4,970	21	24,675	34		19,705
Oct. 6	11	4,110	23	24,670	34		20,560
13	12	4,480	23	24,769	35		20,289
20	11	4,645	26	24,943	37		20,298
27	11	5,400	25	25,135	36		19,735
Nov. 3	10	4,990	26	24,568	36		19,578
10	12	5,010	23	24,920	35		19,910
17	11	3,055	22	24,499	33		21,444
24	12	3,355	24	24,578	36		21,223
Dec. 1	9	2,895	26	26,597	35		23,703
8	6	2,210	28	29,783	34		27,573
15	6	1,805	28	30,083	34		28,278
22	6	1,375	28	29,776	34		28,401
29	5	1,255	30	29,663	35		28,408

TABLE 50.—Wheat futures: Net position data relating to 32 speculative accounts, Chicago Board of Trade, weekly intervals during the calendar year 1923

[In thousands of bushels, i. e., 000 omitted]

Week ended	Number accounts net long	Aggre- gate of net long interests	Number accounts net short	Aggre- gate of net short interests	Total number accounts net long and net short	Difference in net positions	
						Long	Short
Jan. 6.....	7	2,535	14	7,985	21	-----	5,450
13.....	7	2,390	13	7,370	20	-----	4,980
20.....	9	2,870	10	6,470	19	-----	3,600
27.....	11	2,780	9	7,475	20	-----	4,695
Feb. 3.....	11	3,030	9	8,405	20	-----	5,375
10.....	11	3,580	9	6,180	20	-----	2,600
17.....	8	3,935	12	8,380	20	-----	4,445
24.....	8	4,815	12	8,995	20	-----	4,180
Mar. 3.....	9	4,660	11	9,230	20	-----	4,570
10.....	11	4,655	9	7,245	20	-----	2,590
17.....	12	5,080	9	5,850	21	-----	770
24.....	12	5,085	9	5,290	21	-----	205
31.....	11	4,850	12	6,950	23	-----	2,100
Apr. 7.....	11	5,095	8	4,085	19	1,010	-----
14.....	12	5,330	9	4,625	21	705	-----
21.....	9	3,790	11	6,690	20	-----	2,900
28.....	8	3,170	11	7,175	19	-----	4,005
May 5.....	12	3,440	8	6,930	20	-----	3,490
12.....	10	3,060	8	7,505	18	-----	4,445
19.....	10	3,990	9	8,745	19	-----	4,755
26.....	10	3,565	10	8,215	20	-----	4,650
June 2.....	10	2,910	7	6,850	17	-----	3,940
9.....	12	3,205	9	8,435	21	-----	5,230
16.....	10	3,440	10	7,340	20	-----	3,900
23.....	9	1,590	11	8,190	20	-----	6,600
30.....	7	1,155	10	6,135	17	-----	4,980
July 7.....	7	1,265	10	6,670	17	-----	5,405
14.....	5	935	13	7,520	18	-----	6,585
21.....	7	935	12	7,475	19	-----	6,540
28.....	5	830	14	7,885	19	-----	7,055
Aug. 4.....	4	1,710	9	5,130	13	-----	3,420
11.....	4	3,435	9	5,455	9	-----	2,020
18.....	5	2,970	10	6,755	15	-----	3,785
25.....	4	1,995	7	5,255	11	-----	3,260
Sept. 1.....	5	1,745	11	6,820	16	-----	5,075
8.....	6	1,490	9	5,525	15	-----	4,035
15.....	4	895	9	6,130	13	-----	5,235
22.....	5	870	9	5,925	14	-----	5,055
29.....	7	1,480	7	5,650	14	-----	4,170
Oct. 6.....	10	2,340	2	1,000	12	1,340	-----
13.....	8	2,310	4	2,000	12	310	-----
20.....	6	1,515	6	2,810	12	-----	1,295
27.....	7	2,130	6	3,155	12	-----	1,025
Nov. 3.....	7	2,620	6	3,135	13	-----	515
10.....	5	1,940	11	5,855	16	-----	3,915
17.....	5	2,020	11	5,960	16	-----	3,940
24.....	5	2,080	11	4,585	16	-----	2,505
Dec. 1.....	5	2,275	7	2,090	12	185	-----
8.....	6	2,170	4	2,075	10	95	-----
15.....	4	2,110	4	1,770	8	340	-----
22.....	3	1,710	8	2,635	11	-----	925
29.....	3	1,425	8	3,875	11	-----	2,450



TABLE 51.—Grain futures: Aggregate open interests "on the street" (one side only) for clearing members, Chicago Board of Trade, by grains and for all grains combined, at monthly intervals, for the period January, 1921, to December, 1923

[Open interests "on the street," in thousands of bushels, i. e., 000 omitted]

Date	Wheat futures	Corn futures	Oats futures	Rye futures	Barley futures	All futures
1921						
Jan. 31	82,297	90,336	46,440	5,587	717	225,377
Feb. 28	73,641	92,795	43,383	5,373	690	215,882
Mar. 31	75,906	110,518	64,337	6,755	760	258,276
Apr. 30	72,611	89,687	61,934	8,857	393	233,482
May 31	59,684	80,278	54,119	7,413	83	201,577
June 30	86,389	102,902	68,374	8,956	92	266,713
July 31	71,542	57,535	56,473	4,286	112	189,948
Aug. 31	88,776	64,195	78,234	6,870	284	238,359
Sept. 30	93,676	49,212	76,993	7,509	257	227,647
Oct. 31	92,726	52,567	73,162	7,949	214	226,618
Nov. 30	108,183	59,683	80,134	10,954	72	259,026
Dec. 31	93,651	49,128	59,976	5,731	60	208,546
1922						
Jan. 31	84,510	48,409	55,196	5,732	45	193,892
Feb. 28	105,715	88,381	65,949	8,401	55	268,501
Mar. 31	96,195	77,515	62,933	8,560	65	245,268
Apr. 30	84,301	64,565	66,965	7,656	70	223,557
May 31	80,325	58,016	47,653	6,366	5	192,365
June 30	88,249	82,297	60,114	10,180	40	240,880
July 31	80,559	46,110	38,477	9,116	25	174,287
Aug. 31	95,140	49,781	49,607	14,437	101	209,066
Sept. 30	69,287	43,634	35,099	9,731	55	157,806
Oct. 31	83,904	58,786	37,110	11,625	75	191,500
Nov. 30	90,108	73,684	37,113	13,281	85	214,271
Dec. 31	85,211	60,697	29,758	13,838	None.	189,504
1923						
Jan. 31	81,414	64,054	26,373	11,238	None.	183,079
Feb. 28	83,566	65,363	28,705	12,422	None.	190,056
Mar. 31	84,959	61,288	27,996	14,467	None.	188,710
Apr. 30	102,472	71,335	33,207	18,253	5	225,272
May 31	78,449	46,972	18,803	12,522	None.	156,746
June 30	73,361	48,013	19,736	13,003	25	154,138
July 31	79,346	36,924	14,424	9,522	60	140,276
Aug. 31	96,671	38,606	21,962	11,965	60	169,264
Sept. 30	63,747	32,702	18,460	10,291	None.	125,200
Oct. 31	71,555	45,526	18,739	11,493	None.	147,313
Nov. 30	82,695	44,163	20,262	14,119	None.	161,239
Dec. 31	77,818	38,554	16,548	10,526	None.	143,446

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## REPORT OF THE CHIEF OF THE BUREAU OF HOME ECONOMICS

UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF HOME ECONOMICS,  
*Washington, D. C., September 26, 1924.*

SIR: I have the honor to present herewith the report of the Bureau of Home Economics for the fiscal year ended June 30, 1924.

LOUISE STANLEY, *Chief.*

HON. HENRY C. WALLACE,  
*Secretary of Agriculture.*

The Bureau of Home Economics was formed July 1, 1923, as a part of the general scheme of reorganization of the Department of Agriculture. Secretary Wallace recommended to Congress that the scientific research in home economics formerly conducted in the Office of Home Economics of the States Relations Service, be organized into a separate bureau. No increase in appropriation was asked.

The request for the establishment of this bureau in the Department of Agriculture came as the result of the recognition of the necessity for more inclusive scientific study of the problems of home economics if this subject is to develop and make the contribution to our national life which it should. The Department of Agriculture has a definite responsibility in developing home economics work through its relation to the land-grant colleges, in which home economics is one of the major divisions. It has a more direct responsibility in furnishing scientific information on this subject to be carried out by the extension agents under the Smith-Lever Act. Sound programs for resident and extension teaching in any line must be based on fundamental research in that line. Home economics has been weak in that it has lacked a sufficient background of fundamental information developed by scientific research.

The main efforts during the past year have been toward working out the organization, following the lines laid down by the committee called by the Secretary in June, 1923, to out-

line the work of the new bureau. The personnel of this committee, chosen from the leaders of home economics so that all phases of the work would be represented, was as follows: Mary E. Sweeny, Dr. Louise Stanley, Ruth Wardall, Dr. Helen Thompson, Dr. Ruby Green Smith, Edna White, and Mrs. Mary Hinman Abel. They recommended the following divisions of work for the bureau: Food and nutrition, clothing and textiles, economics (including household management), housing and equipment, home relations, art in the home (including the physical and psychological laws of color, line, and form).

In order that this program might be adapted as closely as possible to the needs of women in the home, Secretary Wallace asked the presidents of several women's organizations to send representatives to a conference held in Washington on December 14, 1923. The following women represented their organizations:

Mrs. Winfield Smith, League of Women Voters.  
Mary E. Sweeny, General Federation of Women's Clubs.  
Mrs. A. H. Reeve, National Congress of Mothers and Parent-Teacher Associations.  
Lida Hafford, National Council of Women.  
Mrs. Ella A. Boole, National Women's Christian Temperance Union.  
Mrs. Ethel Puffer Howes, American Association of University Women.



Lita Bane, American Home Economics Association.

Mrs. Charles Schuttler, The Rural Women.

It was the consensus of opinion of these women that the proposed plan covered the material or mechanical side of home life. On the other hand, they considered it important that the less tangible side should be emphasized. The most fundamental problems facing the thinking home woman today involve decisions of what to do. Many agencies are telling her how to do the various household tasks, but it is equally important to give her motives for doing them and to attach to the various duties such clear-cut standards of value in relation to all the aspects and contributions of home life that she will be helped in knowing what to do and what may be left undone. Such careful weighing of values is needed by the housewife in organizing her working time, in apportioning the material resources of the family, and in all the choices she constantly makes that bear on the material and social well-being of her family. Such studies must necessarily be based on the facts gathered through the Division of Economics of the bureau, but they need to be carried further by the proposed Division of Home Relationships.

In view of the restricted funds available it seemed wise to expand slowly, starting with the work already under way and adding divisions in order of need and as it seemed possible to obtain satisfactory personnel.

A large proportion of the work already established was in food and nutrition, and this has been continued and the section organized directly under the supervision of the chief of the bureau. It is hoped to add during 1925 a chief for this division. A further statement regarding the work of this division is given on page 3.

The work being done in the respiration calorimeter laboratory seemed to contribute more directly to certain other bureaus than to the Bureau of Home Economics. As a result of a conference with the bureaus concerned it was decided to transfer this laboratory to the Bureau of Animal Industry so that the work could be more closely tied up with other contemplated projects in that bureau and be more adequately supervised. The four members of the staff connected with the calorimeter laboratory were assigned to the Bureau of Animal Industry for the latter half of the fiscal year and trans-

ferred to the rolls of that bureau on July 1, 1924.

The Office of Home Economics had during the last two years cooperated with the Bureau of Agricultural Economics in studies of standards of living among farm families. The aim in these studies has been to collect data showing not only the cost but the quality of the living with a view to determining to what extent farm families are attaining a reasonable standard for food, clothing, housing, and other items of the family budget, as well as for some of the social features of the home. Such figures on consumption are needed as a guide to production if agriculture and other basic industries are to be developed to the greatest national advantage. One of the most interesting aspects of this important problem is the proportion of the family living that is now or might be furnished by the farm. These standard of living studies, therefore, form an important part of the work of the Division of Economic Studies of this bureau at present, and plans have been drawn for more extensive research in consumption. Hildegard Kneeland came to the bureau on February 1, 1924, as chief of this division. A more detailed statement of this work is given on page —.

The Office of Home Economics had at various times published bulletins on subjects pertaining to clothing and textiles. Only a small amount of research on this subject had been conducted in the office, and the bulletins had been prepared in the main by persons brought in on temporary appointment for the purpose. The numerous inquiries coming to the bureau indicated the desirability of organizing a division of textiles and clothing as soon as possible to inaugurate much needed research studies in this field. The present price of clothing and textiles, together with the complex problems of selection presented by the many types of fabrics now offered on the market, make it imperative that experimental studies be made of the effect of these variations on the durability and specific usefulness of the materials from the standpoint of the consumer. The present widely expressed desire for definite information upon which economic judgments may be based gives such studies timely importance. The closely related problems of household care and conservation of clothing also need more scientific study. Clothing design and construction as met both in the selection

of ready-to-wear garments and in their construction in the home is of interest at this time when there is a growing realization of the extravagant expenditure of money and energy demanded by fashion. Studies dealing with the application of the fundamental principles of artistic design to dress and also the time-saving methods of satisfactory home construction are very much needed. Ruth O'Brien joined the staff of the bureau on June 16, 1924, as chief of the Division of Textiles and Clothing.

In view of the fact that the bureau had no increased appropriation for the fiscal year 1924 and that the increase for 1925 was small, it seemed wiser to postpone the establishment of other divisions. We have, however, cooperated with the Division of Agricultural Engineering of the Bureau of Public Roads in a study of oil burners for heating, and arrangements have been tentatively made for two part-time workers to prepare bulletins on different phases of housing and equipment.

The nucleus of a reference library of books, pamphlets, and miscellaneous material on home-economics subjects not otherwise accessible has been assembled and classified, and plans have been laid for the organization and expansion of the library service to correspond with the growth of the bureau.

At the end of the fiscal year 1924, therefore, scientific work in the bureau is being conducted under three divisions: Food and nutrition, economic studies, textiles and clothing. Preliminary steps have been taken toward the formation of a fourth division—housing and equipment. The staff also includes a librarian and an editor, both with special training in home-economics work. An assistant to the chief is soon to be appointed to help with matters of administration and personnel and to answer the general correspondence. Since the announcement of the plans of the bureau more than 5,000 letters have been dictated in response to inquiries from homemakers, teachers, and other professional workers who are looking to a Federal bureau of home economics as a clearing house for information on many phases of this subject.

### FOOD AND NUTRITION

Increased knowledge of the importance of fresh vegetables in the diet and of the conditions under

which the food value is decreased has made necessary a study of methods of preparation which will popularize the use of vegetables and conserve their food value. Various ways of cooking 70 vegetables have been tested, and the results of this work are now ready for organization in the form of a popular bulletin.

A study of the shortening power of fats has been concluded and the results prepared for publication. In connection with this study, certain fats were investigated for the Bureau of Animal Industry to determine whether the claims of the manufacturers of puff-pastry shortening that a certain percentage of water was necessary could be justified. It was found that these fats gave a very much better puff pastry than those in which water had not been incorporated and a superior product to one made from the same fat after the water had been removed. It was concluded that the manufacturers were justified in the inclusion of the water, provided the product was so labeled as not to be confused with the other household fats in which no water is allowed.

Bread has been prepared from 10 soft winter-wheat flours in order to determine the changes necessary in these soft-wheat flours to make a bread which compares with that made from hard winter wheat. It was found that by increasing the amount of sugar used to 6 parts and yeast to  $4\frac{1}{2}$  parts they yielded a bread that compared favorably with that made from hard-wheat flour. The flavor of the breads made from these flours was equal in every way to those made from hard-wheat flour. A lower number of loaves resulted per barrel of flour and the staling was more rapid in loaves made from soft-wheat than from hard-wheat flour. It is proposed to continue this investigation.

The studies on the internal temperature of foods during cooking has been continued with eggs. It is proposed now to summarize these results.

In connection with the work done in the Bureau of Chemistry on brining as a means of preserving vegetables this bureau was asked to determine whether the products so prepared could be used in the home in any other way than in the preparation of pickles. Salting is an easy method of taking care of surplus products, but it is important to know whether they can be utilized later to advantage. It was found that string beans, onions, and gherkins could be used successfully



only in pickles. Green tomatoes and green peppers gave good results as cooked vegetables. The green tomatoes were used successfully in making bordeaux sauce, green-tomato pie, and mock mince meat, as well as green-tomato pickle. The salted peppers were satisfactory for stuffing as well as for seasoning vegetable dishes and pickles. This method of preserving the surplus green peppers that are usually caught by an early frost might very well be recommended. Salted mangoes make not only good pickles but also a candied product with a characteristic flavor.

At the request of the food control laboratory of the Bureau of Chemistry a study was undertaken to determine whether there was a difference in the flavor of preserves made from fresh fruit and from fruit after canning and storage. Peaches only were studied, and it was decided that the flavor of preserves suffered somewhat when canned fruit was used for this purpose.

Six types of sweet potatoes were studied at the request of the Bureau of Plant Industry to determine whether the cooking quality was affected by varying factors in storage. It was found that the cooking quality is much less affected by variations in storage temperature than has sometimes been supposed.

A suggestion came to the bureau that tough meat might be more extensively utilized if the housewife were shown how to make it tender by the use of papaya leaves, which contain a proteolytic enzyme known as papain. It was found that by means of this enzyme the meat could be made more tender. This action, however, was confined to the surface layers and interfered so much with the flavor that it was concluded that it made no contribution to meat cookery that could not be accomplished by long, slow cooking.

The increasing use of insulin in the treatment of diabetes has emphasized the importance of the diet in this disease. So many requests have come to the bureau for information on the types of food best adapted to the use of diabetics, on ways of preparing such foods so as to make them attractive and palatable, and on methods of calculating the diet that it seemed desirable to compile such information for publication for the use of persons who could not have the constant help of a trained dietitian. This question was submitted to the Surgeon General

of the Public Health Service, and the cooperation of that organization was obtained in the development of this project. Fortunately, it was possible to obtain for this a young woman who is herself a diabetic and who has worked with one of the best-known diabetic clinicians. This study is still in progress, but as soon as possible a preliminary report will be issued. Dr. W. A. Orton, of the Bureau of Plant Industry, has assisted materially by calling to our attention some of the less-known vegetable foods particularly desirable for diabetics. This project might well be continued with special emphasis on the study of the forms of carbohydrates in some of the less well-known vegetables and nuts, with a view to increasing the list of those that may be used by diabetics. There should also be developed, if possible, for making products simulating breadstuffs, a flour of low calorie content that can be either prepared at home or placed on the market at a low price. The cost of insulin makes it doubly difficult in many cases for diabetics to supply themselves with many of the special foods recommended.

From the results of experiments of various kinds of wheat flours conducted in the Office of Home Economics, supplemented by some additional work, a new manuscript has been prepared to supersede Farmers' Bulletin 1136, "Baking in the Home." This is practically ready for publication.

The Playground and Recreation Association of America asked the bureau to contribute the chapter on diet and nutrition to the manual entitled "Camping Out," published last spring for the use of camp directors. It is hoped that this material may be extended during next year and put out in such a form that it may be used in institutions feeding children. The suggestion has come from the Children's Bureau of the United States Department of Labor as to the need for such a bulletin.

Considerable progress has been made during the year in collecting data on food composition for use in the revision of Office of Experiment Stations Bulletin 28, "Chemical Composition of American Food Materials." It is hoped that this bulletin may be sent to press before the end of the next fiscal year. The records of food composition are being kept in such form that with little difficulty new material can be inserted, and in the future this bulletin be kept up to date.



## ECONOMIC STUDIES

The Division of Economic Studies reports the following work:

During the past year the figures on clothing expenditures from the standard of living study made in Livingston County, N. Y., have been summarized so as to furnish the cost of clothing used by men and women of various ages in farm homes. As a result it was found desirable to draw up for use in future studies a clothing classification that would be generally acceptable. To this end a representative of the bureau cooperated with a committee appointed by the American Home Economics Association, and such a standard classification has been prepared.

In connection with the standard of living studies in farm homes, this division has cooperated with the Bureau of Agricultural Economics in the revision of the schedules used for collecting this information. It also has conducted the field work of a study in Vermont, in cooperation with the State agricultural extension service, and has begun the editing and tabulating of data from a similar study in Maryland made by the Bureau of Agricultural Economics. Certain problems connected with surveys made in other States are also being studied in this bureau.

In order to simplify the keeping of time records by housewives, this division has prepared a clocklike chart that reduces the effort on the part of the housewife to a minimum. About 3,500 copies of this have been distributed to housewives, who are cooperating by furnishing figures on the utilization of time in the home. In connection with this study there has been prepared a schedule of supplementary information necessary for the housewife to supply in order that the time records may be interpreted, and also a classification of home activities that will serve as a basis for compiling the data from these time studies. At present 500 daily time records have been classified and 200 summarized.

## PUBLICATIONS AND EXHIBIT MATERIAL

Two department bulletins have been issued, one giving the results of a series of experiments on the digestibility of raw starches and carbohydrates with women as subjects, and the other, entitled "Family Living in Farm Homes," reporting the first of the standard of living studies of farm

families discussed under the work of the Division of Economic Studies. The revision of four bulletins and a circular has been completed and is underway on several others. A circular giving time-tables for the home canning of fruits and vegetables has been published in order to meet the pressing demands for information on this subject. In the meantime a more complete discussion of home canning based on the most reliable scientific data available is being prepared for issuance in the farmers' bulletin series.

In addition to these publications in the regular series of the department, three articles reporting results of some of the earlier digestion experiments have been published in scientific journals, and a "Selected List of Government Publications on Foods and Nutrition," containing 165 citations annotated and classified according to subject, has been issued, particularly for the use of professional home-economics workers. Over 2,500 copies of this list have been distributed through this bureau and the extension service. About 125 popular articles discussing the organization and plans of the bureau, as well as giving practical suggestions on food selection and meal planning and many other important household problems, have been sent out through the Press Service for use in newspapers and magazines.

In cooperation with the Office of Exhibits three booths, under the general title "Food and Health," have been prepared by the bureau for the series of exhibits forming a part of the extension program on range livestock, dairying, and human nutrition in the 11 western range States. The importance of proper nutrition on the physical and mental development of children and what constitutes a well-balanced diet are the main themes brought out by means of legends and various types of colored and lighted illustrations. The bureau also planned and cooperated in the preparation of two other booths showing the principles of bread making and of clothing selection for use of the extension service. The bureau hopes to be able to extend its service along this line during the next year. Numerous calls for exhibit material have been received from agencies other than those served by the Office of Exhibits of the department. In so far as possible these have been met by sending mounted sets of bulletins, charts, and photographs representing the work of the bureau.









## REPORT OF THE INSECTICIDE AND FUNGICIDE BOARD

UNITED STATES DEPARTMENT OF AGRICULTURE,  
INSECTICIDE AND FUNGICIDE BOARD,  
*Washington, D. C., September 10, 1924.*

SIR: I have the honor to submit herewith the report of the work of the Insecticide and Fungicide Board for the fiscal year ended June 30, 1924.

Respectfully,

J. K. HAYWOOD,  
*Chairman.*

HON. HENRY C. WALLACE,  
*Secretary of Agriculture.*

The Insecticide Act of 1910 is a regulatory law designed to prevent the manufacture, sale, or transportation of insecticides or fungicides (including disinfectants) which are below the strength claimed for them, which will not accomplish the results promised, which are injurious, or which fail to comply with any other provisions of the act, the purpose being to eliminate untruthful and misleading statements from labels. The Insecticide and Fungicide Board aids the Secretary of Agriculture in the enforcement of this law.

The preparations sought to be regulated by the insecticide act include articles for application to crops, animals (including poultry), households, schools, hospitals, and human beings to rid them of insects and fungi. The industry is of constantly increasing economic importance and touches nearly all phases of human activity. "Swat the fly," "Kill the tick," and similar slogans result in increased production and use of insecticides and fungicides. The spread of the boll weevil, the outbreak of the Japanese beetle, the increasing attention paid to all phases of sanitation in the home and on the farm and in all places of public assemblage, the annual problem of the mosquito, clothes moth, fly, tick, poultry and cattle lice, and insects and fungi infesting the crops and gardens, result in the mar-

keting of large number of remedies. The production figures are not available, but new preparations are constantly being advertised, all of which require the attention of this board. It is a never-ending work, which must continue to increase in volume and importance.

Some of the preparations offered for sale have no proper background of experimental work. Some manufacturers believe that the purchasers should do the experimental work for them, instead of demonstrating the value of their own preparations before offering them for sale. The fact that an insect can be captured and then killed by the application of a certain formula is no assurance that the insect will be harmed in its natural habitat by spraying the so-called remedy into the air, on the plant, or about the premises. The Department of Agriculture, many State agencies, and various scientific organizations are applying themselves to the development of means of combating man's insect and fungous enemies. The problem is not an easy one and can not be successfully solved by other means than thorough experiments by competent, specially trained, and honest unprejudiced persons. Persons who spend their money for new discoveries made by promoters are often not only wasting their money, but, more important, are losing the opportunity to apply the

proper remedies and are risking their crops, their stock, or their health.

The investigation of such remedies engages the attention of the board, but during the time required for proper experiments the preparations are on the market, and much loss is sustained by purchasers. The products are eventually driven from the market, but the losses of time, money, crops, stock, and health have been needlessly suffered.

During the year the board has continued vigorously its campaign against preparations which are represented to be effective against chicken lice, chicken mites, blue bugs, and other external parasites infesting chicken when fed in the food or drinking water. Tests have been completed of a large number of such preparations and in no case have they been found to be effective. A notice has been published in the Announcements of the board warning manufacturers of the ineffectiveness of such preparations and conveying the opinion of the board that it is extremely doubtful if any substance or mixture of substances will be found effective in the control of external parasites when fed to chickens. A number of seizures have been made of shipments of these products and criminal prosecutions have been instituted under the provisions of the insecticide act. The simplicity of the method advertised for freeing poultry of external parasites evidently is very popular with people whose inclination is to accept some easy way of getting rid of a troublesome job.

The board has continued its campaign against various so-called boll-weevil remedies which do not control the boll weevil when used as directed. Prosecutions have been instituted against a number of manufacturers on the basis of tests already made; further tests of other remedies are being made this year. It has been found that the mixtures sold by a number of manufacturers are not effective in controlling the boll weevil when used through the growing season as directed on the labels. It has been found further that some of these mixtures contain considerable quantities of water-soluble arsenic and are injurious to the cotton plant. In carrying out these tests it is necessary to test the preparations on a practical scale in southern cotton fields throughout the growing season. This requires a tremendous amount of work, and probably it will be several years before worthless or nearly

worthless preparations can be driven from the market. Funds have been requested of Congress to carry on this important campaign more vigorously.

Tests that have extended over four or five years have been completed of a number of preparations recommended for the control of scale insects in general or the control of the San Jose scale. Among the preparations tested are the dry lime-sulphurs of a number of manufacturers, dry soda-sulphur compound, and a dry barium-sulphur compound. It has been found that none of these, used in accordance with the directions of the manufacturers, are effective in the control of San Jose scale. The results of this work will be published later. During the meantime the various manufacturers have been cited under the terms of the insecticide act, and such action will be taken as the facts justify after the answers to the citation have been thoroughly considered by the board.

The campaign against adulterated and misbranded disinfectants of various kinds has been continued throughout the year. Special attention has been given to pine-oil disinfectants sold for general disinfecting purposes, whereas tests have shown that the material was not effective except against a limited class of germs. A notice to manufacturers of pine-oil disinfectants has been issued in Service and Regulatory Announcements No. 48, covering this matter.

Special attention has been given to paradichlorobenzene powders and blocks, erroneously sold as disinfectants, and a notice relative to this has also been published in Service and Regulatory Announcements No. 48. Special attention has also been given to disinfectants which are recommended for use at too great a dilution to be effective. A great improvement has been brought about in the labeling of disinfectants in general. Paradichlorobenzene blocks and powders bearing disinfectant claims on the label have nearly disappeared from the market. Many labels for pine-oil disinfectants have been satisfactorily corrected and the dilutions for many other disinfectants have been diminished. However, much work along this line is still necessary, since new disinfectants are constantly appearing on the market. This campaign will therefore be continued.

The campaign against so-called pine-oil disinfectants and coal-tar dips and



disinfectants adulterated with mineral oil, started in 1921, was continued, with the result that this form of adulteration has almost entirely disappeared. Work along this line will be continued to a sufficient extent to prevent a return by some manufacturers to this fraudulent practice.

The campaign inaugurated in 1919 involving the inspection of the domestic supply of calcium arsenate used for cotton-boll weevil control was continued. It was found that for the most part the calcium arsenate now being manufactured is very satisfactory. The manufacturers have so perfected their manufacturing operations that nearly all the calcium arsenate now appearing on the domestic market is up to a satisfactory standard; i. e., contains a sufficient amount of total calcium arsenate to effectively control the weevil and does not contain an excess of water-soluble arsenic.

As during 1923, a considerable amount of calcium arsenate has been offered for import during the present year. Upon inspection a marked improvement was shown over the calcium arsenate offered for import last year. While some shipments have had to be excluded, most of the calcium arsenate now offered for import is up to a satisfactory standard.

The campaign to improve the quality and labeling of Bordeaux and of Bordeaux-lead arsenate mixtures has been continued with noteworthy progress. Not only have the labels on most of these products been brought into entire conformity with the law but the unbalanced ratio between the copper and arsenic which still existed in some of the Bordeaux-lead arsenate products has in most cases been satisfactorily corrected. The campaign has been extended to include also those copper-bearing materials which on account of the nature of the composition of the ingredients can not be classed strictly with the Bordeaux mixtures. Improvement in the labels of such products has also been quite marked and usually in accordance with the suggestions of the board.

The campaign started during 1919 against insect powders adulterated with daisy flowers and insect flower stems was continued, with the result that very few samples of insect pow-

der thus adulterated now appear on the American market. This campaign will be continued.

An attempt was made to collect the various new household insecticides appearing on the market. It was found that many of the samples did not bear the active and inert ingredient statement required by section 8 of the act, and that a considerable number bore false and misleading claims relative to the insects they would control. Prosecutions have been instituted against some of the manufacturers of such preparations, and a large number of the labels have been corrected after correspondence with the manufacturers. The work will be continued.

### INTERSTATE SAMPLES

During the year the board reported to the Solicitor of the department 87 cases presenting alleged violations of law, with recommendations that the facts be transmitted to the Attorney General to institute criminal action or seizure proceedings. Disposition was made of 324 cases by correspondence with the manufacturers. These cases presented violations which were technical only, not flagrant, or cases in which the manufacturer gave reasonable and adequate explanation of his failure to conform to the provisions of the act. Action was taken to place in abeyance 744 samples which upon examination and test were shown to be in compliance with the provisions of the law or were from shipments of the same goods made prior to shipments for which the manufacturer had been convicted and had after citation conformed to the requirements of the law. On June 30, 1924, 147 cases were pending preliminary hearings or before the board for final action, 270 were held in temporary abeyance pending the receipt of further information or the outcome of prosecution based on the same product or correspondence with the manufacturers, and 523 samples were undergoing analysis and test.

The inspectors and sample collectors of the board, operating throughout the United States, collected samples from 824 shipments. A general classification of the articles represented in the collection is as follows:

## Interstate samples collected

Class of samples	Number	Class of samples	Number
Arsenate of calcium.....	30	Miscellaneous insecticide and fungicide preparations.....	71
Arsenate of lead.....	33	Lice and mite killers.....	91
Bordeaux mixture and combinations of Bordeaux mixture with insecticides.....	45	Lime-sulphur solutions and sulphur preparations.....	42
Chlorinated lime.....	3	Mange preparations.....	23
Dips for animals.....	26	Nicotine preparations.....	22
Disinfectants, germicides, bactericides.....	99	Paris green.....	13
Fly preparations for animals.....	25	Pyrethrum and hellebore powders.....	72
Fish-oil and whale-oil preparations.....	13	Miscellaneous.....	38
Formaldehyde preparations.....	8		
Insect preparations, household use.....	170		824

## IMPORT SAMPLES

During the year, 167 official and unofficial import samples of insecticides and fungicides were collected through the various port laboratories of the Bureau of Chemistry for examination and test by the board. Disposition was made of 172 samples. Seventeen official samples were found adulterated and misbranded, and it was recommended that the consignments be refused entry until correctly labeled. The remaining samples were unofficial, 22 of them being found to be adulterated or misbranded, or both, and in these cases it was recommended that future shipments be detained, while 129 were neither adulterated nor misbranded. Four official samples were found to be neither adulterated nor misbranded and the shipments were released.

## SPECIAL INVESTIGATIONS

The investigations started during 1923 to determine the active principles of two species of larkspur seed (*Delphinium consolida* and *D. staphasagria*) have been continued and a paper embodying the results obtained to date has been published in the Journal of the American Pharmaceutical Association (vol. 13, p. 696, August, 1924) under the title "The Isolation and Properties of the Alkaloids and Oil of Larkspur Seed, *Delphinium consolida*." In this article the physical and chemical properties of the pure oil are given. The yield of oil was 25 per cent of the weight of the seed. Three alkaloids were isolated in crystalline form and the composition of two of these definitely established: Delcosine, empirical formula  $C_{21}H_{35}NO_6$ , melting point 198–199° C, and delsoline, empirical formula  $C_{25}H_{41}NO_8$ , melting point 207–209° C. The third alkaloid obtained has not yet been sufficiently purified

to determine its formula or physical constants. As time allows, the entomologist is testing the oil and alkaloids against various insects, but such tests are not yet completed. Similar work on *D. staphasagria* is now in progress.

The investigation to determine the rate of loss of nicotine from nicotine-soda soap and nicotine-potash soap preparations has been completed and the results published in an article entitled, "The Deterioration of Soap-Nicotine Preparations" in Industrial and Engineering Chemistry, vol. 16, p. 819, August, 1924. This work showed that hard soaps made from sodium hydroxide, menhaden fish oil, and free nicotine solution lost nicotine rapidly on storage regardless of the type of package. Potash soaps (soft soap) and soft soda soaps containing nicotine retained practically their original nicotine content for a period of four years.

The results obtained indicate that the change in the nicotine depends on the physical condition of the soap and not on excess of alkali, the kind of alkali, the use of heat in the preparation of the mixture, or on the type of package. The work also shows that the decrease in nicotine content in the hard soaps was not due to loss of nicotine by volatilization but to chemical changes by which it was converted apparently into insoluble polymeric form, or a condensation product. The fact that the decrease in nicotine was accompanied by a decrease in the fatty acids of the soap is an indication that there was probably some reaction between the two.

The study to determine the rate of loss of nicotine from so-called nicotine dusts has been completed and the data will be published as Department Bulletin No. 1312, Loss of Nicotine from Nicotine Dusts During Storage. Dusts were prepared using free nico-

tine solution and nicotine sulphate solution, with various carriers and packed in different types of containers. The results showed that:

(1) The loss of nicotine from dusts containing nicotine sulphate was in the following order, beginning with the lowest: Kaolin, kieselguhr, talcum, calcium sulphate (gypsum), calcium hydrate, and calcium carbonate.

(2) Dusts containing "free" nicotine lost their nicotine more rapidly than those containing nicotine sulphate. The effect of the carriers, however, is in about the same order.

(3) Canvas bags, pasteboard boxes, and paraffined boxes are unsatisfactory containers for nicotine dust preparations and should not be used. Air-tight metal or glass containers only should be employed for the commercial packing of these materials.

The chemical work in connection with the investigations started in 1921 to determine the rate of loss of available chlorine from bleaching powder has been completed and the data are now being assembled for study. As was to be expected, the rate of loss is influenced by a number of factors. In general this loss is on an average about 1 per cent per month.

Work on the basic arsenates of calcium has been delayed pending the construction of certain necessary apparatus for carrying out the equilibrium reactions. It is expected that the work on "The System Arsenic Pentoxide, Calcium Oxide and Water (Basic Section)" will be completed during the coming year.

Cooperative work in collaboration with the Bureau of Entomology is now in progress to determine the toxicity of the various arsenates of calcium and their relative insecticidal value.

A method for the determination of free lime in calcium arsenate has been developed, which is of great assistance and time saving in the examination and study of commercial preparations of this material. By its use the presence of basic calcium arsenate in commercial calcium arsenates has been demonstrated. A description of this method will be published in the September issue of *Industrial and Engineering Chemistry*.

As a result of the work on analytical methods, a tentative method entitled "Method for the Determination of Arsenic in the Presence of Sulfides, Sulfites, Thiosulfates, or large Amounts of Sulfur" was adopted by the Association of Official Agricultural Chemists (*Journal of the Association of Official Agricultural Chem-*

*ists*, vol. 7, no. 4, p. 315, May, 1924). The hydracine distillation method for total arsenic (*Journal of the Association of Official Agricultural Chemists*, vol. 5, p. 402, 1922) was adopted as an official method (*Journal of the Association of Official Agricultural Chemists*, vol. 7, p. 319, 1924).

The special studies of the pathologists of the board have in the main been conducted along two lines of endeavor: (1) Quantitative tests with several of the composite materials which still seem to be unbalanced in their makeup to determine the limits of safety consistent with disease control, and at the same time, if possible, arrive at the cause of injury to plants or trees resulting from applications of such materials, with the definite view of being better able to direct revision of labels or to correct faulty composition of the materials themselves. (2) Qualitative tests with special types of materials of peculiar composition to ascertain their value for use as dependable fungicides against our more important crop diseases. Both types of tests have resulted in marked success either in improvement of the labels, in the composition and quality of the materials, or in the elimination of such products from the market.

Inasmuch as many commercial mixtures now contain calcium arsenate instead of lead arsenate as the insecticide it is important to know what injury, if any, may be expected from its use. Tests therefore have been conducted on different kinds of foliage with this material in conjunction with the standard fungicidal treatments, lime sulphur and Bordeaux mixture, for the benefit of the board in facilitating correct judgment of certain labels.

The studies on dry mix as a substitute for lime-sulphur solution in the summer application on apples have been continued, especially since this product has become commercialized and is now being sold under label. The value of the addition of casein spreaders to spray mixtures has been the subject of study continued from previous seasons.

Special studies with an increasing number of materials which are being offered for use in the dust form have been continued during the year. Some of these materials seem utterly devoid of the physical properties which may make their use as dusts possible.

Several materials being offered on the market for the cure of fire-blight on apple and pear trees have also been the subject of tests. Negative results



were obtained and drastic revision of labels in these cases was found to be necessary.

The work of the entomologists of the board on chicken mites has been completed and published as United States Department of Agriculture Department Bulletin No. 1228, "Results of Experiments with Miscellaneous Substances Against the Chicken Mite."

Certain portions of the experiments with dry substitutes for liquid lime-sulphur as remedies against the San Jose scale have been completed and submitted for publication.

Special attention has been given to the effect of various materials as fly repellents, larvacides, and as remedies against adult flies.

In cooperation with the Bureau of Entomology extensive field tests have been conducted in Louisiana to determine the value of sweetened poisons as remedies against the cotton boll weevil.

Additional work has been carried on to determine the effect of various arsenicals and oil sprays on the foliage of a representative series of trees, shrubs, and plants, and much valuable data have been obtained.

In cooperation with the Bureau of Entomology an extensive series of ex-

periments has been made with remedies to be given in the food and drinking water for the control of external parasites of poultry and with the ingredients entering into the composition of such remedies. So far no evidence has been found to indicate that any of these preparations are of value against the common external parasites of poultry.

The scientific workers of the Bureau of Animal Industry engaged upon board problems have continued their investigations concerning the insecticidal activity of the ingredients of ground sabadilla seed, referred to in the report for last year. Interesting facts in this connection have been brought out and will be published.

In cooperation with the Zoological Division of the Bureau of Animal Industry investigations are being conducted on various phases of the question of insecticides in relation to insects parasitic on livestock, such as cattle and hog lice, flies, mange mites, and ticks. Worthy of special mention are some investigations concerning the efficacy of hydrocyanic gas on cattle ticks and tests to determine the activity of certain drugs reputed to have insecticidal properties against psoroptic, sarcoptic, and follicular mange.







## REPORT OF THE LIBRARIAN

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
OFFICE OF THE LIBRARIAN,  
*Washington, D. C., September 10, 1924.*

SIR: I have the honor to submit herewith the executive report of the library for the fiscal year ended June 30, 1924.

Respectfully,

CLARIBEL R. BARNETT,  
*Librarian.*

Hon. HENRY C. WALLACE,  
*Secretary of Agriculture.*

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The fiscal year 1924 is the sixty-second year of the library's existence, as it may be said to have been established in 1862, the date of the establishment of the department. While a number of the reports of the Commissioners and Secretaries of Agriculture for the years subsequent to 1862 contained references to the library, the first printed report of the librarian on the work of the library was not issued until 30 years ago as a part of the annual report of the Secretary of Agriculture for the fiscal year 1894, the year of the reorganization of the library under the direction of William P. Cutter. No printed reports were issued for the years 1895 to 1897, but separate reports have been issued annually for all subsequent years. The present report is, therefore, the twenty-eighth printed report of the library.

The persons in charge of the different lines of work of the library during the past year were as follows: Miss Emma B. Hawks, assistant librarian, in general charge of reference and bibliographical work and circulation; Miss Helen M. Thompson, chief, catalogue and order division; Miss Lydia K. Wilkins, chief, periodical division; Miss Elizabeth G. Hopper, supervisor of binding; Miss Ethel E. Smith, secretary to the librarian, in charge of correspondence, files, and personnel records; and Richard T. Umhau, library accountant. The names of the librarians of the various bureaus are given on page 4. The following report on the work of the past year is compiled and condensed from the detailed reports submitted by the bureau librarians and the chiefs of the divisions of the main library.

### ACCESSIONS

At the time the library was reorganized in 1893 it contained less than 45,000 volumes. On July 1, 1924, it contained 174,451 accessioned books and pamphlets, having quadrupled in size in the 30 years. The number of accessioned books and pamphlets added during the past year was 6,004, while 21 publications no longer needed were discarded, making the net accessioned additions for the year 5,983. There were, however, also acquired 8,193 catalogued volumes and pamphlets, mostly serials, which did not receive accession numbers because they were either in temporary binders or were later to be bound in volumes with other numbers of the same series. The total catalogued accessions numbered 14,199. Of these there were added, by purchase, 2,320 volumes, 123 pamphlets, 436 serials and continuations, and 68 maps. The additions by gift and exchange were 1,029 volumes, 1,022 pamphlets, 39 maps, and 5,534 continuations. In addition, 3,928 were added by the binding of periodicals and serials. Of the latter 2,128 were permanently bound and 1,800 were in temporary binders. The periodicals received currently numbered 3,142, of which 2,136 were received by gift or exchange. Detailed statistics of accessions are given in Appendices 5 and 7.

Among the more important of the old books acquired during the year were the following: Belon, *L'histoire de la Nature des Oyseaux*, 1555; Belon, *Les Observations de Plusieurs Singularitez*, 1588; Blome, *The Gentleman's Recreation*, 1709-10; Bradley, *The*

Gentleman and Gardeners Kalendar, 1718; Chandler, *Camellia Britannica*, 1825; Communications to the Board of Agriculture, London, 1802-13; Cook, *The Manner of Raising, Ordering, and Improving Forest and Fruit-trees*, 1679; Dodoens, *Crvydt-boeck*, 1644; Elliot, *A Monograph of the Paradiseidae*, 1873; Estienne, *L'agriculture, et Maison Rustique*, 1602; Fuchs, *De Historia Stirpium Commentarii Insignes*, 1549; Gould, *A Monograph of the Ramphastidae*, 1854; Hill, *The Profitable Arte of Gardening*, 1572; L'Obel, *Plantarvm sev Stirpium Historia*, 1576; Löhneyss, *Zwey Gute und Sehr Nützliche Bücher von Stangen und Mundstücken*, 1609; Ludwig, *Ectypa Vegetabilium*, 1760; Morison, *Plantarum Historiae Universalis Oxoniensis*, 1680-99; Maxwell, *Bee Master*, 1750; Poiteau, *Flore Parisienne*, 1813; Prince, *Sketch of the Agricultural History of Queens County, N. Y.*, 1861; Reid, *Scots Gardener for the Climate of Scotland*, 1756; Richardson, *Fauna Boreali-Americana* . . . part 2, *The Birds*, by Swainson, 1831; Rusden, *A Further Discovery of Bees*, 1679; Selater, *A Monograph of the Jacamars and Puff-birds*, 1822; Sharpe, *A Monograph of the Alcedinidae*, 1867-71; Sharpe, *A Monograph of the Hirundinidae*, 1885-94; Smith, *Florists' Museum* [1838?]; Temminck, *Nouveau Recueil de Planches Coloriées d'Oiseaux*, 1838; Turner, *Libellus de Re Herbaria Novus*, 1877.

Among the important and expensive purchases of recent books special mention should be made of the following: Anderson, *Zoology of Egypt*, *Mammalia*, 1902; Beccari, *Palme della Tribù Borasseae*, 1924; Dawson, *Birds of California*, 1923; Federation of British Industries, *Resources of the Empire*, 1924; Godman, *A Monograph of the Petrels*, 1907-10; Landolt and Börnstein, *Physikalisch-chemische Tabellen*, 5th ed., 1923; Michie, *The Encyclopedia of the United States Supreme Court Reports*, 1908-23; Miyoshi, *Description of Iris*, 1921; Miyoshi, *Description and History of the Cherry*, 1921; Philipps, *Natural History of the Ducks*, v. 2, 1923; Rothschild, *The Avifauna of Laysan*, 1893-1900; Smith, *Veterinary Notes*, rev. ed., 1889; Society of Dyers and Colourists, *Color Index*, 1924; Thorburn, *Game Birds and Wild Fowl of Great Britain and Ireland*, 1923; Times Survey Atlas of the World, 1920-22.

Some of the important sets of periodicals which were completed or nearly completed during the year were as

follows: *British Birds*; *Fühlings Landwirtschaftliche Zeitung*; *Gardeners' Magazine*; *Journal für Ornithologie*; *Midland Florist*; *Royal Horticultural Society, Proceedings*; *Scottish Arboricultural Society, Transactions*; and *Der Tierärztl.* In addition, 35 volumes were added to the library's file of *Bon Jardinier*.

The library also acquired an unusually large number of out-of-print but less expensive books and pamphlets which have been on its list of desiderata for many years. These, as well as many of the expensive books, were secured as a result of the librarian's visit to European book dealers during the summer of 1923.

The number of books, periodicals, and pamphlets received by gift from institutions, publishers, and private individuals represents a very considerable increase over those received in the previous year. These contributions to the library are greatly appreciated.

During the years 1922 and 1923 the library for the first time in its history, as far as is known, received several gifts of money, ranging from \$20 to \$150. These were received from members of the staff of the Bureau of Agricultural Economics for the purchase of economic books, as noted in the reports for the past two years. This year a gift of \$12.94 was received from Dr. C. J. Galpin, of the same bureau. Special mention of these gifts is made, not because of the financial aid rendered, though this is much appreciated, but because of the interest which they evince in the library and its upbuilding. The cooperation and interest of the staff of department in increasing the library's resources are invaluable. Aid can be rendered not only by gifts of money and publications, but by calling attention to desirable acquisitions, for the library needs to have its own efforts supplemented by the expert knowledge of the literature of their subjects possessed by the investigators of the department.

### CATALOGUING

There was a decided increase in the amount of cataloguing done during the past year. A record was kept for the first time of the cataloguing of volumes of periodicals and other serials which were in temporary binders. These numbered 1,800 and account in part for the large increase as compared with the four previous years. But even deducting this number from the total number of volumes and pamphlets catalogued, the balance, 13,199, is still



large and an increase of 3,941 over the previous year, or more than 33 per cent. This increase is due to the fact that there were fewer changes in the cataloguing staff during the year, as there were no resignations among the experienced cataloguers and it was not so frequently necessary to detail them to other divisions of the library to fill temporary vacancies. Another contributing factor in the increased amount of work done was the simplification of the procedure in the cataloguing of serials and multigraphed material. Finally, the increase testified to an increased efficiency in the cataloguing force.

While the number of cards added to the catalogue is smaller than in previous years, this is largely due to the delay at the Library of Congress in the printing of cards, which work has been hampered by lack of funds. Many manuscript cards sent to the Library of Congress as early as December, 1923, had not been printed by July 1, 1924. The statistics in regard to the cataloguing are given in Appendix 6.

### USE OF THE LIBRARY

The total number of books recorded as circulated by the main library and the bureau libraries was 85,548; of periodicals, 268,480, making a total of 354,028. This shows an increase of 2,807 over the previous year in the number of books circulated. It is impossible to compare this year's circulation of periodicals with the circulation of last year, as two of the bureaus kept the circulation statistics for the first time this year. No records are kept of the reference use of the library and certain of the bureau libraries keep no record of circulation. The main library also keeps no record of the circulation of current periodicals, since the bulk of its circulation is to the bureau libraries, which send the periodicals direct to the readers. The recorded circulation of books and periodicals therefore represents only approximately the use of the library.

The number of loans to libraries and individuals out of the city was 1,505 as compared with 1,193 for the previous year, an increase of more than a third. In addition, 180 photostat copies and 10 typewritten copies of articles were supplied instead of sending the volumes from which they were taken. The total number of inter-library loans was therefore 1,695, larger by 317 than any past year. The correspondence in connection with in-

terlibrary loans and the supervision of other work which they entail, such as the verification of references and the tracing of obscure references, make large demands upon the time of the assistant librarian, who has charge of this work. The State colleges and experiment stations continue to be the heaviest borrowers, though numerous requests are received also from other scientific institutions, from the research departments of private firms, and from members of the department stationed outside of Washington.

The number of books borrowed by this library from the Library of Congress, the Surgeon General's library, and other libraries in Washington, was 4,002, and 46 were borrowed from libraries outside of Washington. The verification of references so that requests for loans from other libraries may be sent out to them in correct and intelligible form consumes much of the time of the reference librarian. The keeping of the records of such loans and the efforts to have the books returned safely and promptly to the lending libraries take a considerable portion of the time, also, of the loan desk assistant. Detailed circulation statistics are given in Appendices 1 to 4.

The position of reference librarian of the main library, on account of lack of funds, was vacant throughout the year, except for a temporary period in the summer of 1923. The reference work of the main library, therefore, devolved almost entirely upon the assistant librarian. An additional assistant for the reference work is much needed. Quite a large proportion of the persons who make use of the reference facilities of the main library in person are from outside of the department. This is to be expected, since the reference work of the bureaus which maintain libraries is for the most part attended to by these librarians. Among those from outside of the department who made extended use of the main library last year special mention should be made of a number of scientific workers from England, India, Japan, and Sweden who spent several weeks in the library. This increase in the use not only of the main library but also of the bureau libraries by investigators outside of the department, particularly from other Government departments, from the State colleges and experiment stations, and from other scientific institutions, is evidence of the importance of the library's collections. The aggregate amount of time spent by various members of the staff of the



main library and the bureau libraries in serving the users of the library not connected with the department, if computed, would, it is believed, amount to at least three persons' full time and possibly more. Since the department itself is national in service, it has seemed a legitimate function of the library to extend its service to scientific workers outside of the department in so far as possible without interfering with the work of the department.

### BUREAU AND DIVISION LIBRARIES

A list of the branch libraries in the bureaus and divisions of the department, with statistical data in regard to them, is given in the accompanying table. An account of the bibliographical work of the bureau libraries is given under the heading "Bibliographical work," and statistics of circulation are given in the table, Appendix 1.

#### *Books, pamphlets, and periodicals in bureau, division, and office libraries*

Bureau or office	Number employed	Number of books	Number of pamphlets	Number of periodicals currently received	Number of registered borrowers	Number of registered borrowers to whom periodicals are circulated
Bureau of Agricultural Economics, Miss Mary G. Lacy, librarian.....	<sup>1</sup> 14	24, 000	( <sup>2</sup> )	<sup>3</sup> 1, 874	310	<sup>4</sup> 120
Bureau of Animal Industry, Miss Carrie B. Sherfy, librarian.....	3	2, 700	<sup>3</sup> 2, 940	604	126	120
Animal Husbandry Division, Mrs. H. Callahan, in charge.....	1	3, 797	2, 702	261	46	-----
Bureau of Chemistry, Miss Louise Duvall, librarian.....	<sup>1</sup> 4	<sup>3</sup> 8, 550	( <sup>2</sup> )	461	255	115
Bureau of Entomology, Miss Mabel Colcord, librarian.....	3	8, 979	10, 325	790	<sup>3</sup> 115	23
Forest Service, Miss Helen E. Stockbridge, librarian.....	1	<sup>5</sup> 23, 967	( <sup>2</sup> )	162	156	67
Bureau of Home Economics, Miss Mabel A. Nye, librarian.....	<sup>1</sup> 2	( <sup>2</sup> )	1, 673	106	23	23
Bureau of Plant Industry, Miss Jessie M. Allen, librarian.....	<sup>1</sup> 10	<sup>3</sup> 600.	<sup>3</sup> 1, 100	920	( <sup>6</sup> )	177
Bureau of Public Roads, Miss Orrena L. Evans, librarian.....	3	<sup>3</sup> 2, 678	<sup>3</sup> 7, 416	256	125	103
Office of Experiment Stations, Miss Martha L. Gericke, librarian.....	<sup>1</sup> 8	<sup>3</sup> 3, 600	<sup>3</sup> 12, 000	<sup>3</sup> 950	65	65

<sup>1</sup> Including messengers.

<sup>2</sup> Figures not available.

<sup>3</sup> Approximate figures.

<sup>4</sup> Offices.

<sup>5</sup> Books and pamphlets.

<sup>6</sup> Book circulation handled in main library.

The only radical change in any of the bureau libraries during the year occurred with the discontinuance of the States Relations Service as such on July 1, 1923, and the rearrangement of its work. The States Relations Service library then became known as the library of the Office of Experiment Stations. It nevertheless continues to serve practically the same group of people, including the Extension Service, which is no longer officially connected with the Office of Experiment Stations. The former assistant librarian, Miss Ethel A. L. Lacy, resigned in the fall of 1923 to accept a position in the Detroit Public Library. Miss Cora L. Feldkamp, former librarian of the Office of Farm Management of the department, and more recently reference librarian of the

Michigan Agricultural College, was appointed in her place. Among the regular duties of the Office of Experiment Stations library is the careful daily examination of all periodicals and books relating to agricultural science received in the department library, for the purpose of calling the attention of the editors of the various sections of the Experiment Station Record to articles suitable for abstracting. Analysis is also made of publications of the United States Department of Agriculture, the State agricultural experiment stations, and the State agricultural extension services in assigning these for abstracting in the Experiment Station Record. A part of the work of this library also consists in looking after the library collections of the Federal experiment stations in Alaska, Porto Rico,

Hawaii, Guam, and the Virgin Islands. It also aids the main library in connection with the State experiment station publications by preparing these publications for binding each year and by completing the files. During the past year 778 volumes were sent to the bindery by the Office of Experiment Stations, this number including volumes for the insular stations and State station publications for the department library, as well as volumes for the library of the office. There were received during the year 15,495 new publications, issued by the United States Department of Agriculture and the State agricultural experiment stations, this number including copies needed for binding sets of these publications for the libraries of the office, the United States Department of Agriculture, and the insular experiment stations. The work of collecting a library of publications of the United States Department of Agriculture and the State agricultural experiment stations for the library of the experiment station of the Virgin Islands is now practically completed. So far, 1,571 volumes have been sent, of which 692 were collected in bound form. The bulletins, circulars, etc., contained in the other 879 volumes had to be collected, cleaned, mended, collated, and put into binders.

The Bureau of Home Economics, up to July 1, 1923, an office of the States Relations Service, had had a bibliographical assistant for the office since 1919, under the general supervision of the States Relations Service library. This service has now been developed into a bureau library which has been getting under way during the past year. Miss Mabel A. Nye, who was formerly the bibliographical assistant in the Office of Home Economics, was appointed librarian. The library has had a number of gifts during the year, including 121 books from the editorial office of the *Journal of Home Economics*. Such of these as were not duplicates were accessioned and catalogued in the main library, but the complete collection is filed in the bureau library.

In the Bureau of Agricultural Economics library an increasing demand for reference and bibliographical work made necessary the appointment of a special assistant for this work. A simpler method of routing current periodicals to the various offices has been established and the periodical records and files are in greatly improved condition. These improvements have helped to reduce the number of assistants in the periodical room from three and one-half to two. While Congress

is in session the Congressional Record is read each day by an assistant in the bureau library and any items of interest are brought to the attention of those in the bureau to whose work they pertain, and copies of all bills, resolutions, and amendments of interest are obtained as promptly as possible and made available by indexing. A special arrangement has also been made by which information of the publication of hearings before Congressional committees is secured promptly, thus giving the library a better chance of obtaining the hearings themselves. A new piece of work which has been undertaken is the systematic compilation of information relating to sources of statistics and other economic data for foreign countries. This work was not begun until May and since that time four German series have been analyzed for these data.

The Bureau of Plant Industry library, after being unsettled for more than a year, due to the transfer of its collections and catalogues to the main library, as described in the report for last year, was in October, 1923, located in rooms 127, 128, and 129 of the west wing. The double room is used for a reading and reference room and for periodical circulation records, the single one for mailing-list work, sorting and routing books and periodicals. The decrease in the circulation of current periodicals to the bureau, as shown in the table in Appendix 1, is explained by the fact that many of the journals which were formerly sent to the bureau library for indexing are no longer needed, as the indexing is done at the main library by the bureau library assistants whose desks are there. In response to requests from the personnel office of the bureau, considerable time has been spent in the preparation of bibliographical lists of books and articles by bureau scientific workers. Another special undertaking of the past year has been an attempt to supply the needs of bureau workers outside of the city to whom it is not always feasible to send books and journals desired, because the demand for use in Washington is too great, or for other reasons. They have felt the deprivation, as their library facilities are usually inadequate. In order to give them more prompt service, it has been possible in some instances to procure extra copies of reports of societies and other publications which were available without charge. Short articles in periodicals or portions of books have been copied on the typewriter, but more frequently articles



have been photostated. The cost of the photostat work is charged to the office maintaining the field station, and the copy is retained by the station permanently if desired. The plan has seemed to give general satisfaction. It was decided that it would be an advantage to field workers to know what books were available at other stations in their vicinity and also that some duplication of copies could be avoided if the resources of the neighboring stations were known. Therefore, lists of the books at the various stations have been prepared. These are grouped by geographical sections, the Southwest, Cotton Belt, Mississippi Valley, etc. It is expected to have these lists mimeographed in the near future and distributed in the sections interested.

The librarian of the Bureau of Entomology reports a marked increase in the circulation for the year. She also calls attention to the crowded condition of the library, which makes imperative an additional room for the library in the near future. The bureau library has received during the year two most acceptable gifts—the working collection on Iridae and Forest Insects gathered through years of service by Dr. A. D. Hopkins and given by him to the library in August, when he gave up this line of work, and a complete set of the valuable *Bulletin of Entomological Research* (14 volumes), an additional copy of which was needed and which was given by the Imperial Bureau of Entomology, London.

The libraries of the Bureau of Animal Industry, Bureau of Chemistry, and Forest Service report no marked changes in their work during the past year. In the Bureau of Public Roads library there was a considerable increase in the circulation of both books and current periodicals.

### BIBLIOGRAPHICAL WORK

The bureau libraries have continued to do a very considerable amount of bibliographical work, both in response to current demands and as a general aid in bureau work.

The most important bibliography compiled and issued during the year by the Bureau of Agricultural Economics library is that entitled "Marketing of agricultural products," which is No. 7 of the mimeographed series of bibliographical contributions of the United States Department of Agriculture library. This consists of 133 pages and is a revision of a previously issued mimeographed list, with several

supplements. In making this revision each title has been examined and annotations have been made where the nature of the material was not sufficiently clear from the title. Numerous other short bibliographies have been compiled by the bureau library during the past year, and among them a mimeographed list of 13 pages on agricultural economics. Some of the longer typewritten lists were one of 11 pages on long-time agricultural programs in the United States and one of 22 pages on the world's food supply. Closely related to the bibliographical work is the library supplement to the Bureau of Agricultural Economics News (mimeographed). During the calendar year 1923 this was issued every two months. Beginning with January, 1924, it has been issued every month. The general plan followed is to include as the chief feature each month a short list of references, usually annotated, on some subject of timely interest in the work of the bureau. In addition to these lists, short reviews are given in each issue of recent accessions of special interest and abstracts of periodical articles of sufficient interest and importance to be called to the attention of bureau workers.

The Bureau of Animal Industry library compiled, primarily for use in connection with the World's Dairy Congress which was held in October, 1923, a "Partial list of publications on dairying issued in the United States, 1900 to June, 1923," which was issued in mimeographed form as Bibliographical Contributions No. 6 of the United States Department of Agriculture library. The list is 236 pages in length and consists of five parts: (1) Publications of the State agricultural experiment stations, 1900 to June, 1923, inclusive; (2) Publications of the United States Department of Agriculture, 1900 to June, 1923, inclusive; (3) books issued or revised since 1908; (4) periodicals; (5) subject list.

The Bureau of Chemistry library, as for several years past, has issued monthly a mimeographed list of patent specifications received, which list is sent regularly to 30 individual chemists and offices, who select the specifications they desire. A bibliography of the history of food adulterations is in progress. A list of books to aid in the popularization of chemistry has also been prepared.

The Bureau of Entomology library began work in the latter part of the year on the continuation of the printed Index to the Literature of American Economic Entomology. This volume



will cover the years 1920 to 1924, inclusive. In addition, various brief bibliographies relating to entomology were prepared during the year.

The "List of bulletins of the agricultural experiment stations in the United States from their establishment to the end of 1920," which has been in preparation in the Office of Experiment Stations for some time, was issued on May 26, 1924, as United States Department of Agriculture Bulletin 1199. The bulletin so far lists approximately 12,500 publications, primarily the regular bulletin series, and it is planned to issue biennial supplements, the first of which, listing the bulletins issued during the calendar years 1921 and 1922, was issued in August. Another bibliography prepared by the Office of Experiment Stations during the year was a "Selected list of references on scientific and technical writing," which was presented by Dr. A. C. True as the bibliographical report to the Association of Land Grant Colleges at its annual convention in Chicago, November 14, 1923, and published in their proceedings. Owing to the demand for it, mimeographed copies were made and distributed on request.

The monthly list of books and articles indexed in the Forest Service library is still published in the *Journal of Forestry*. Several new special bibliographies have been prepared by the Forest Service library for distribution during the year. Among the most important of these were the following: *Forest Problems in the Northeastern States*, *Woodlot Forestry*, *Erosion*, *Thinning*, and *Some Books on Forestry in English*.

The current indexing of botanical literature carried on by the Bureau of Plant Industry library with the cooperation of the office of economic and systematic botany has increased greatly in the past year. The list of "Current author entries," which is issued semi-monthly, now averages 20 pages as compared with 14 pages last year. This is due to the fact that Miss A. C. Atwood, bibliographical assistant of the Bureau of Plant Industry, who prepares the list, has had her desk in the main library during the past year. This has made it possible for her to see the current periodical mail and the book accessions more promptly and regularly, thus eliminating the chance of missing publications which before never came to her attention.

The verifying and editing of citations to literature in the manuscripts for the Bureau of Plant Industry publications and the *Journal of Agri-*

cultural Research has continued to be an important part of the bibliographical work of the Bureau of Plant Industry library. It required during the year nearly the full time of one assistant and part of the time of another assistant. Bibliographies in 262 manuscripts, comprising 3,556 references, were verified. In addition, a number of lists of literature on special subjects were prepared in the library in response to requests. Among the most important of these were a list of illustrated books on orchids contained in the library of the department and in the Library of Congress, a list on parasitism and disease resistance, and one on collectors and explorers in Venezuela.

The Bureau of Public Roads library has continued to issue each week the mimeographed list of articles in periodicals of interest to this bureau. A bibliography compiled in the Division of Agricultural Engineering for publication was edited by the librarian of the bureau and numerous short bibliographies have been prepared in answer to letters and in response to requests from bureau workers.

The important card indexes in the various bureau libraries, which have been referred to in previous reports, have been maintained as usual during the year.

In the main library the bibliographical work has been confined to short lists supplied in answer to letters. The list of important accessions to the library has been published each week in the *Official Record*.

## BINDING

Only in certain branches of the work of the library is it possible to record quite definitely the increases or decreases in the amount of work accomplished without spending an undue amount of time in the keeping of the records. In binding work this is possible. The amount accomplished last year greatly exceeded the amount accomplished in any of the six preceding years and also slightly exceeded the amount accomplished in the fiscal year 1915, the banner year of the binding work. This increase was no doubt due largely to the fact that it was possible this past year to appoint an additional assistant for the binding work, but credit is also due to the hard work of the supervisor and her assistants and to the improvement in the binding routine. In spite of the increase in the binding for the past year, the condition of the shelves is far from satis-

factory on account of the great arrears in the binding for the preceding years, due to lack of funds and assistants.

The binding and preservation of daily and weekly statistical newspapers, such as the livestock reports, is becoming more and more a problem on account of the space required for filing them and the time required for putting them in binders. During the past year the Bureau of Agricultural Economics turned over to the library long back files of these publications, which required nearly a month's time of two of the binding assistants in collating and putting in binders. As all available filing space for these publications has now been used, it will be necessary to provide additional cases during the coming year. The binding statistics of the past 10 years are given in Appendix 8.

### DUPLICATES

The library accumulates a large number of duplicates of State, Government, and society publications and periodicals, as these are sent as gifts to various offices of the department and later are turned over to the library, which in many cases has already received copies. In spite of the time consumed in handling these duplicates, it has been the policy of the library to encourage the bureaus and offices to send their exchanges to the library, as valuable additions are often received in this way. The disposition of these duplicates is, however, a serious problem. In addition to the duplicates received as gifts, it is necessary to dispose of the periodicals which are purchased in duplicate to meet the

needs of current circulation. During the past year the accumulation of the duplicates had become so large that it became imperative to give them special attention, though it was most difficult to spare the time for the work. Various lists of the more important books and serials were sent to book dealers and librarians out of the city and book dealers and librarians in the city were asked to look over the collections. As a result of these efforts the accumulation of duplicates was not only greatly reduced, but in addition the library received in exchange publications which it desired amounting in value to \$954.75. This was a much needed addition to the limited book funds of the library.

### EXCHANGES AND MAILING LISTS

During the year 2,154 orders, as compared with 1,709 for 1923, were issued on the office of publications for the mailing of department publications which were requested by foreign institutions and officials and by societies and private individuals from whom publications are received in exchange. The total number of addresses appearing on the foreign mailing lists maintained by the department for exchange purposes does not differ greatly from the number reported in the past few years, being approximately 4,000, in addition to the list of 1,000 addresses to which the monthly list of publications of the department is sent.

### ORDER WORK AND BOOKKEEPING

The record of the order work and bookkeeping for the last four years is given in the accompanying table.

*Order work and bookkeeping, 1921-1924*

	1921	1922	1923	1924
Requisitions issued for periodicals and books.....	1,569	2,060	2,481	2,333
Requisitions issued for supplies.....	67	83	126	77
Shop requests.....	132	122	160	233
Requisitions for printing and binding.....	41	77	49	47
Vouchers audited for payment.....	956	1,176	1,337	1,234

A comparison of the receipts and expenditures of the library for the past 10 years is given in the table in Appendix 10.

### LIBRARY STAFF

There were 6 resignations and transfers from the bureau libraries during the year as follows: One assistant

librarian, 2 library assistants, 1 library aid, 1 clerk, and 1 messenger.

In the main library there were during the year 6 resignations and 2 transfers. Of these 8 who resigned or were transferred, 1 was a library assistant, 2 were library aids, 2 were clerical assistants, and 3 were messenger boys. The library assistant resigned to accept a position at a higher salary in another



office of the department. Of the 2 library aids who resigned, 1 left to enter library school and the other to accept a position in another department at a higher salary. One of the clerical assistants accepted a position outside of the Government at a higher salary and the other a position in one of the bureaus of the department.

During the year 2 of the newly appointed library assistants of the Bureau of Agricultural Economics were at different periods detailed to the main library for a month, for the sake of the experience and also to aid the main library.

The number of employees carried on the main library staff at the close of the fiscal year was 40. Of this number, 4 were temporary assistants whose appointments terminated on June 30. The number employed by the bureau and office libraries was 48. The total number employed in the main library and the bureau and office libraries was 88. Of these, 13 were in administrative positions, including the librarian of the department, the heads of divisions in the main library, and the librarians of the bureaus; 35 were library assistants; 13 were library aids; 12 were clerical assistants; 1 was a translator; 11 were messengers; and 3 were charwomen.

In continuance of the library's policy of offering temporary appointments whenever possible to librarians and library assistants connected with the State agricultural college and experiment station libraries who wish to have experience in this library, 2 more were added last year to the list of such appointments, the reference librarian of Clemson College having worked in the library for nearly a month in the summer of 1923 and the librarian of the Georgia experiment station for the month beginning June 16, 1924.

Staff meetings, including the staffs of both the main library and the bureau libraries, were held monthly from October to June. At the May meeting a talk was given by Miss Emma Baldwin, director of the training class of the District of Columbia Public Library, on a graduate library school. At the June meeting a talk was given by Dr. C. J. Galpin, chief of the office of rural life

and farm population, Bureau of Agricultural Economics, on the work of his office. At the October and November meetings the librarian described her European trip. At the other meetings talks were given by other members of the library staff of the bureaus and the main library on various phases of the library work.

The librarian of the department served throughout the year as a member of the following committees of the American Library Association: The nominating committee, the committee on Federal and State relations, the committee on the transfer of war funds, and the committee on the Eunice Rockwood Oberly memorial fund. The librarian of the Bureau of Agricultural Economics served as a member of the methods committee of the Special Libraries Association, and also as secretary of the agricultural libraries section of the American Library Association.

The librarian of the department spent two months in Europe during the summer of 1923 for the purpose of purchasing books for the library. Book dealers were visited in London, Cambridge, The Hague, Paris, Geneva, Rome, and Vienna. Many desiderata were obtained and in addition valuable contacts were established with book dealers with whom the library had not previously had dealings. A number of important agricultural and scientific libraries were also visited and arrangements made for an exchange of publications.

#### ARRANGEMENT OF LIBRARY

In the report for last year mention was made of the additional rooms acquired by the library in the basement, which provided space for 108 double-face sections of shelving. They were not completed until last winter. The services of a temporary assistant were then secured for shifting the books, as it was necessary to shift about three-fourths of the library. The work required nearly three months' time. The books are now in a better arrangement than they have been in for several years and the physical condition of the library in general is greatly improved.



## APPENDIX 1

*Combined statistics of circulation*

Bureau	Number of books charged								Number of periodicals charged	
	To individuals		To main library		To branch libraries		Total			
	1923	1924	1923	1924	1923	1924	1923	1923	1923	1924
Main library.....	20,646	21,044	-----	-----	25,432	24,501	46,078	45,545	(1)	(1)
Bureau of Agricultural Economics.....	(1)	15,225	(1)	1,501	-----	-----	13,211	16,276	(1)	119,592
Bureau of Animal Industry.....	4,753	4,163	285	271	(1)	(1)	5,038	4,434	47,605	46,712
Bureau of Chemistry.....	7,962	7,983	757	710	121	133	8,840	8,826	26,133	26,314
Bureau of Entomology.....	2,844	3,815	264	385	94	61	3,202	4,261	2,884	3,099
Forest Service.....	2,754	2,245	394	433	15	9	3,163	2,687	7,452	7,345
Bureau of Home Economics.....	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	-----	1,439
Bureau of Plant Industry.....	-----	-----	-----	-----	-----	-----	-----	-----	58,009	47,722
Bureau of Public Roads.....	3,138	3,434	66	85	5	-----	3,209	3,519	14,215	16,257
	42,097	57,909	1,766	2,935	25,667	24,704	82,741	85,548	156,298	268,480

<sup>1</sup> Figures not available.

## APPENDIX 2

*Circulation statistics of the main library, by months and years, for the fiscal years 1915 to 1924*

Month	1914-15	1915-16	1916-17	1917-18	1918-19	1919-20	1920-21	1921-22	1922-23	1923-24
July.....	3,019	3,077	2,932	3,113	2,860	2,687	2,827	3,681	3,017	3,066
August.....	2,567	3,285	2,883	3,027	2,616	3,216	2,867	3,152	2,959	2,920
September.....	2,793	3,334	2,955	2,968	2,232	2,678	2,790	2,866	3,044	2,922
October.....	3,903	4,183	4,421	3,617	2,474	3,444	3,101	3,845	4,219	3,688
November.....	3,352	4,439	4,409	3,462	2,684	2,981	3,381	3,650	4,576	3,817
December.....	3,570	4,140	3,797	3,137	2,728	2,897	3,369	3,448	4,084	3,346
January.....	4,260	4,888	4,839	4,099	3,572	3,668	3,932	3,749	4,357	4,613
February.....	3,638	4,715	4,625	3,603	3,830	3,346	3,481	3,773	4,445	4,425
March.....	3,980	5,028	4,640	3,676	3,920	3,699	3,840	4,481	4,663	4,732
April.....	3,514	4,052	3,766	3,444	3,608	3,497	4,444	3,239	3,826	4,205
May.....	3,072	4,136	3,616	3,531	3,327	3,103	3,326	3,319	3,716	4,224
June.....	3,285	3,637	3,476	2,770	2,606	3,085	3,483	3,691	3,172	3,587
Year.....	40,953	48,914	46,339	40,447	36,457	38,301	40,841	42,894	46,078	45,545

## APPENDIX 3

## INTERLIBRARY LOANS

*Record of books lent outside of Washington during the fiscal years 1915 to 1924*

States, etc.	Fiscal year—									
	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
Alabama	3		10			10	17	5	6	8
Arizona	4	14		7	4	4	23		1	11
Arkansas	2	3	4	5	9	19	32	21	24	23
California	26	50	38	13	28	43	16	18	29	52
Colorado	27	24	16	7	5	10	18	9	37	13
Connecticut	4	2	2	5	1	7	13	5	5	10
Delaware	11	10	6	17	11	30	21	28	35	84
Florida	44	21	15	21	17	7	5	13	33	73
Georgia	15	37	24	5	4	6	12	31	15	14
Idaho	9	5	10	6	4	8	1	7	1	4
Illinois	7	66	30	44	49	23	20	17	13	6
Indiana	25	20	13	11	4	13	38	7	32	24
Iowa	63	80	40	52	15	22	72	59	69	82
Kansas	59	71	38	31	41	22	3	23	15	14
Kentucky	25	7	4	8	13	15	13	30	34	49
Louisiana	2	10	8	21	9	5	5	15	15	10
Maine	8	22	16	10	2	3	1		1	12
Maryland	25	28	48	30	10	21	24	17	66	117
Massachusetts	36	25	33	22	10	37	16	34	37	30
Michigan	22	37	38	21	9	17	50	24	41	44
Minnesota	64	78	50	44	63	89	88	44	60	59
Mississippi	4		1	1	1		4	2	2	5
Missouri	18	15	19	6	2	10	6	22	21	30
Montana	5	15	19	37	17	13	7	6	38	26
Nebraska	20	18	16	4		15	7	7	14	10
Nevada		3	1	1		1		2	1	
New Hampshire	3	2	8	10	7	6	9	11	22	12
New Jersey	83	53	76	28	42	49	89	63	107	75
New Mexico	3	9	8	6	7	6	11		1	
New York	142	127	148	103	66	85	81	117	101	136
North Carolina	48	17	15	7	1	6	26	43	27	48
North Dakota	3	11	3	6	6	5	14	10	8	15
Ohio	78	29	41	56	9	30	32	35	32	89
Oklahoma						1	7	8	5	1
Oregon	51	66	51	73	5	19	53	30	15	6
Pennsylvania	21	29	19	21	10	30	51	37	35	60
Rhode Island	6	2	17	4	2	12	5	8		1
South Carolina	1	22	27	14	2	2	12	11	15	22
South Dakota	3					3		3		1
Tennessee	20	31	22	19	11	10	11	12	33	8
Texas	23	11	38	8	9	4	21	14	19	19
Utah	8	17	16	8	8	14	19	22	12	45
Vermont	21	9	3	3	10	3	7	12	11	20
Virginia	32	26	18	4	10	19	46	28	38	40
Washington	8	11	2	8	21	12	31	4	7	17
West Virginia	12	16	8	19	19	10	13	15	13	15
Wisconsin	38	41	34	36	62	2	48	63	35	33
Wyoming	4	5	3		6	4	6	11	3	7
Canada	1		1	1	3	1	2			2
Cuba								1		
Hawaii			3	2	1					
Porto Rico	57	43	39	28	11	14	32	9	9	20
Island of Guam					2	1				
Alaska		2				1		1		
Panama										
Haiti										3
Total	1,196	1,240	1,093	893	658	799	1,139	1,015	1,193	1,505
Photostatic copies of articles	101	129	168	84	145	142	78	126	89	180
Typewritten copies of articles	12	9	12	11		17	11	7	8	10
	1,309	1,378	1,273	988	803	958	1,228	1,148	1,290	1,695

## APPENDIX 4

*Summarized statement of books borrowed from other libraries during the fiscal years 1915 to 1924*

Library from which borrowed	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
Library of Congress.....	4,365	5,279	4,629	3,567	4,126	3,385	3,290	3,180	2,953	3,172
Surgeon General's library.....	750	939	962	878	607	476	470	511	364	441
Smithsonian Institution and National Museum.....	130	227	141	124	110	75	100	68	55	90
Geological Survey.....	101	92	57	49	64	73	61	69	50	78
Patent Office.....	19	29	49	25	36	18	20	40	41	44
Bureau of Education.....	15	43	41	4	11	4	21	22	9	15
Public Library.....	20	33	11	13	21	10	18	39	56	28
Hygienic Laboratory.....	3	45	21	15	12	12	3	28	10	20
Bureau of Standards.....	2	2	7	2	2	6	8	17	11	41
Other libraries in Washington.....	56	85	92	40	37	62	86	54	46	73
Total from libraries in Washington.....	5,463	6,774	6,010	4,717	5,026	4,121	4,077	4,028	3,595	4,002
Libraries outside of Washington.....	58	86	82	35	70	39	58	69	53	46
Grand total borrowed from other libraries.....	5,521	6,860	6,092	4,752	5,096	4,160	4,135	4,097	3,648	4,048
Largest number borrowed on any day.....	42	42	41	46	41	30	60	35	37	42
Average number borrowed daily.....	18	23	16	15	16	13	13	13	11	13
Largest number borrowed in any month.....	579	734	623	481	613	458	480	436	431	469
Average number borrowed monthly.....	460	571	507	396	424	346	344	341	304	337

## APPENDIX 5

## ACCESSIONS

The total number of catalogued books, pamphlets, and maps added to the library during the year was 14,499, an increase of 5,241 over the recorded catalogued accessions of the previous year. One thousand eight hundred of these, however, were volumes added by the lacing of periodicals into binders. No record of these was kept during previous years and for this year the number is an estimate based on the records for six months. Without regarding this, the increase is 3,441.

*Accessions to the library for the fiscal years 1915 to 1924*

Accessions	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
Purchases:										
Volumes.....	1,353	1,595	1,949	1,510	1,373	1,989	1,420	1,384	2,040	2,320
Pamphlets.....	39	49	76	79	88	119	47	81	94	123
Maps and charts.....	13	1	4	2	6	3	9	13	68	68
Serials and continuations.....	376	274	147	97	154	187	456	464	300	436
Total.....	1,768	1,931	2,168	1,690	1,617	2,301	1,926	1,938	2,447	2,947
Gifts:										
Volumes.....	780	873	641	676	647	768	774	934	720	1,029
Pamphlets.....	500	397	508	642	371	580	492	751	847	1,022
Maps and charts.....	22	18	4	59	15	21	10	59	15	39
Continuations.....	4,909	4,919	4,458	3,807	2,647	4,762	3,515	5,683	3,684	5,534
Total.....	6,211	6,207	5,611	5,184	3,680	6,131	4,791	7,427	5,266	7,623
From binding periodicals and serials.....	1,085	1,612	1,178	949	748	1,161	768	1,305	1,545	2,128
From lacing periodicals in binders.....	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	1,800
Total.....	9,064	9,750	8,957	7,823	6,045	9,593	7,485	10,670	9,258	14,499

<sup>1</sup> Figures not available.

<sup>2</sup> Record kept for 6 months; 6 months estimated.

According to the record of accessions the total number of books and pamphlets accessioned by the library up to July 1, 1924, was 181,172. From this number should be taken 5,910, which were discarded during the fiscal year 1915, and 811, which have been discarded since that time, leaving a balance of 174,451 accessioned volumes and pamphlets in the library on July 1, 1924.



## APPENDIX 6

## CATALOGUING

The record of the material catalogued during the past five years is as follows:

	1919	1920	1921	1922	1923	1924
Volumes.....	2,020	2,757	2,194	2,318	2,760	3,342
Pamphlets.....	459	699	539	832	941	1,145
Maps.....	17	27	13	68	28	107
Serials and continuations <sup>1</sup> .....	3,549	6,110	4,739	7,452	5,529	9,898
Total.....	6,045	9,593	7,485	10,670	9,258	14,999
Pamphlets <sup>2</sup> .....	273	501	96	229	87	103
"Reprints" <sup>3</sup> .....	2,498	1,937	4,828	2,745	1,502	1,491
Entries for current periodicals <sup>4</sup> .....						221

<sup>1</sup> The figures for 1923 differ from those given in the printed report for 1923, since due to an oversight the 1,545 volumes received from the bindery were not included. The number of serials and continuations catalogued should therefore have been 5,529 instead of 3,984, as was given, and the total number of pieces catalogued should have been 9,258 instead of 7,713.

Previous to 1924 no record was kept of the cataloguing of volumes of periodicals in temporary binders. In the figures for 1924 these have been included. An exact record was kept for six months during which period the number catalogued was 977. The number catalogued for the whole year was therefore estimated to be 1,800. This accounts in part for the large increase over 1923 in the number of serials and continuations catalogued.

<sup>2</sup> Not fully catalogued.

<sup>3</sup> Author cards only.

<sup>4</sup> No record kept previous to 1924.

*Uncatalogued material*

	1920	1921	1922	1923	1924
Volumes.....	274	290	543	1,262	847
Pamphlets.....	599	1,085	1,905	798	3,516
Continuations.....	540	1,105	846	1,541	921
Maps.....	7		19	43	35

*Number of titles prepared for printing by the Library of Congress in the "Agr." series*

	1920	1921	1922	1923	1924
Cards for accessions and recatalogued books.....	817	1,097	786	599	805
Cards for department publications.....	611	627	369	381	432
Cards for foreign agricultural periodicals.....				263	152
Total.....	1,428	1,724	1,155	1,243	1,389

*Record of cards added to the catalogue*

	1920	1921	1922	1923	1924
Number of cards added.....	21,504	23,730	17,148	24,728	20,861
Number of cards withdrawn.....	2,353	4,224	1,739	2,752	2,389
Net addition to catalogue.....	19,151	19,506	15,409	21,976	18,463

## APPENDIX 7

## PERIODICALS

Number of different periodicals currently received by purchase.....	1,005
Number of different periodicals currently received by gift and exchange.....	2,138
Total number of different periodicals received.....	3,143
Number of additional copies purchased.....	203
Number of additional copies received by gift and exchange.....	141
Total number of periodicals purchased, including duplicates.....	1,146
Total number of periodicals received by gift and exchange, including duplicates.....	2,341
Grand total of periodicals received currently, including duplicates.....	3,487

The average number of current periodicals received during April and May, 1924, was 259; during May and June, 1923, 234; during April and May, 1922, 302; during April and May, 1921, 268. The decrease in the number of periodicals received is due partly to the decrease in the number of Japanese periodicals received on account of the earthquake and partly to the decrease in the number of German periodicals purchased. Because of their high prices few duplicates of German periodicals were purchased and few new ones were ordered.

## APPENDIX 8

## BINDING

	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
Number of books sent to bindery.....	3,832	3,363	4,064	1,674	2,019	1,866	1,821	2,858	1,417	3,264
Number of volumes placed in temporary binders.....	2,281	1,684	2,000	1,675	1,612	1,000	1,152	1,059	1,762	2,877
Pamphlets stapled in binders.....	( <sup>1</sup> )	( <sup>1</sup> )	1,728	1,443	743	894	622	675	692	726

<sup>1</sup> Figures not available.

In addition 1,409 current numbers of periodicals, bulletins, and reports were also added to the files already in temporary binders. Owing to pressure of other work, it has been impracticable for the past two years, to do this work as systematically as formerly. Therefore, only the publications of this department and of the State agricultural experiment stations have been laced regularly into binders, and numbers of most other series have been sent to the shelves until several have accumulated. This has reduced the work, but does not keep the shelves in as good condition or protect the publications adequately.

## APPENDIX 9

*Expenditures for Library printing and binding for the fiscal years 1919 to 1924*

Item	1919	1920	1921	1922	1923	1924
Regular binding.....	\$2,734.23	\$8,255.30	\$5,537.74	<sup>1</sup> \$12,723.58	\$6,234.28	\$9,534.40
Binders.....	1,641.23	606.84	1,151.12	( <sup>2</sup> )	660.83	518.89
Pamphlet boxes.....	330.00					48.70
Forms.....	247.82	259.38	241.64	303.26	318.76	283.79
Publications.....	400.36	84.30	94.61	889.17	73.36	88.86
Index cards.....				578.27	157.12	137.93
Miscellaneous.....	4.57	4.88	6.09	55.31	16.20	8.69
Total.....	5,358.21	9,210.70	7,031.20	14,549.59	7,460.64	10,621.26

<sup>1</sup> Includes regular binding and binders.

<sup>2</sup> Separate figures not available; included with regular binding.

## APPENDIX 10

## Financial statement, fiscal years 1915 to 1924

## RECEIPTS

	Fiscal year—									
	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
Source:										
Library appropriation—										
Statutory salaries.....	\$27,860.00	\$29,720.00	\$31,520.00	\$32,160.00	\$32,160.00	\$32,160.00	\$32,880.00	\$30,060.00	\$32,660.00	\$32,660.00
General expenses.....	17,500.00	16,300.00	18,000.00	18,000.00	18,000.00	18,000.00	22,000.00	21,400.00	25,000.00	30,000.00
Total.....	45,360.00	46,020.00	49,520.00	50,160.00	50,160.00	50,160.00	54,880.00	51,460.00	57,660.00	62,660.00
From department printing and binding fund.....	10,190.62	9,662.12	8,707.52	12,068.38	5,358.21	9,210.70	7,031.20	14,549.59	7,460.64	10,621.26
Grand total.....	55,550.62	55,682.12	58,227.52	62,228.38	55,518.21	59,370.70	61,911.20	66,009.59	65,120.64	73,281.26

## EXPENDITURES

Books and serials.....	\$8,300.90	\$8,840.89	\$8,975.89	\$7,257.40	\$7,186.86	\$9,246.05	\$9,439.69	\$9,998.58	\$11,182.48	\$10,944.73
Periodicals.....	3,586.17	3,978.46	4,093.62	4,252.74	6,139.99	5,231.48	6,039.62	6,353.68	7,008.48	6,888.09
Maps.....	40		215.00	40.88	70	62.04		141.88	172.45	147.37
Index cards.....	194.88	169.59	129.07	78.86	85.25	112.23	178.51	29.91	2,435.20	1,738.15
Furniture, shelving, and miscellaneous equipment.....	3,148.23	866.85	552.26	765.88	604.04	293.16	2,525.04	190.23	177.52	1,971.06
Traveling expenses.....		31.20			179.44	48.52	219.72	62.90	13.95	21.51
Freight, express, and drayage.....			10.62	16.24	37.75	93.07	56.94	566.76	1,459.67	1,136.98
Supplies and repairs.....	350.00	429.16	469.24	981.33	609.01	539.58	518.50	9.87	52.78	38.89
Truck service.....									94.16	99.32
Newspapers.....			30,960.32	31,523.92	29,401.95	29,106.85	27,013.25	30,059.01	32,219.04	31,960.67
Salaries (statutory).....	27,798.00	29,634.73	30,960.32	31,523.92	2,039.00	2,356.00	2,921.35	3,931.62	2,394.35	7,774.99
Salaries (miscellaneous).....	1,737.50	1,643.33	2,065.21	1,748.33						
Total.....	45,166.08	45,594.21	47,471.23	46,665.58	46,283.99	47,088.98	48,913.52	51,344.44	57,210.08	61,721.76
Printing.....	1,895.47	1,806.79	1,727.17	1,806.78	652.75	348.56	342.34	1,826.01	579.03	567.97
Binding.....	8,295.15	7,855.33	6,980.35	10,491.60	4,705.46	8,862.14	6,688.86	12,723.58	6,881.61	10,053.29
Grand total.....	55,356.70	55,256.33	56,178.75	58,733.96	51,642.20	56,299.68	55,944.72	65,894.03	64,670.72	72,343.02
Main library salaries paid by bureaus.....						1,467.50	5,221.67	7,560.02	10,472.89	12,257.50

<sup>1</sup> In return for duplicates exchanged with book dealers and libraries publications were received amounting in value to \$954.75, and a gift of \$12.04 was received, making a total of \$967.69 which supplemented the appropriation.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1924











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## REPORT OF THE PACKERS AND STOCKYARDS ADMINISTRATION

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
PACKERS AND STOCKYARDS ADMINISTRATION,  
*Washington, D. C., September 10, 1924.*

SIR: I submit herewith the annual report of the Packers and Stockyards Administration for the fiscal year ended June 30, 1924.  
Respectfully,

CHESTER MORRILL,  
*Assistant to the Secretary.*

Hon. H. C. WALLACE,  
*Secretary of Agriculture.*

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In this the third annual report of the Packers and Stockyards Administration there is shown substantial advance in the administration of the packers and stockyards act.

During this fiscal year there has been considerable progress in developing the organization so as to handle its affairs in an efficient and effective manner, and the experiences of the two previous years have aided in the adoption of sound, permanent policies.

In addition to a number of matters that were pending at the close of the last fiscal period, new problems have developed during the year. Questions that are fundamental are involved in the stockyards valuation and rate cases, the commission-rate cases, the so-called Armour-Morris merger proceeding, the attempts to gain access to packer records, the trading relations among the agencies in the public stockyard markets, and proposed amendments to the packers and stockyards act.

The enforcement of regulatory statutes is always difficult. This is especially true when the ideal is constructive service to an industry and not merely police like functioning. When, in addition, economic conditions in a regulated industry are adverse law administration becomes doubly hard. Such has been the situation in the livestock industry, not only during the fiscal year covered by this report but

throughout the period during which the packers and stockyards act has been in effect. Producers have been impoverished and packing companies have met heavy losses and other financial difficulties of the severest kind. As a result there has been great sensitiveness on all sides.

In June, 1923, the actual average price received by producers at the farm for beef cattle was \$5.82 per 100 pounds. In June, 1924, it was still lower, and stood at \$5.79. In 1913, before the war, the average June price was \$6.02, and all costs entering into production were but little more than half what they were in 1923-24.

In June, 1923, the average hog price at the farm was \$6.37 per 100 pounds. In June, 1924, it stood slightly higher at \$6.55. At that it was over \$1 per 100 pounds less than for the corresponding month in 1913, when the average farm price was \$7.61.

On the other hand, in June, 1913, the feeder had to pay one-third less for his corn than he did in 1924. This situation forced the greatest liquidation in hogs ever witnessed in our country. Over 53,000,000 head were slaughtered under Federal inspection during the fiscal year, 10,000,000 more than the previous high record.

Taking 1913 farm prices as equal to 100, the purchasing power of beef cattle in terms of all commodities in June, 1924, stood at 68 and of hogs at

60. As the 1924 purchasing power of corn stood at 93, it is easy to see that cattle and hogs were constantly losing money to producers. One can not feed 93 per cent corn in 68 per cent cattle and 60 per cent hogs and do anything but lose money.

All these things have contributed to dissatisfaction. Those regulated by the law complain of encroaching governmental activity, while a relatively small number of critics find fault with what they consider insufficient progress by the enforcing staff. To both of these groups we can only say that every effort is made to enforce the act in accord both with its letter and its spirit. It is always easier to criticize than to do a hard task.

### PROPOSED AMENDMENTS TO THE ACT

During the fiscal year several bills proposing amendments to the packers and stockyards act were introduced in Congress. These reflect to some extent the experience and viewpoints of the administration and the various groups in the livestock industry gained through participation in and observance of the operation of this law since its passage. In general, this proposed legislation touched the following principal lines:

(1) Modifying the act with reference to the operation of certain State laws.

(2) Defining and altering the existing rights and liabilities of cooperative market agencies operating at public stockyard markets. Some of these were designed to restrict, and others to enlarge, the rights and privileges of such agencies.

(3) Prohibiting direct buying by packers at private yards (of the type of the Mistletoe yards at Kansas City) at places where there are public stockyard markets.

(4) Giving greater authority to the administration over the employment of the weighers and dockers at public stockyard markets.

(5) Simplifying and making more effective the "cease and desist" procedure.

(6) Requiring bonds of persons engaged in business as market agencies or dealers at public stockyard markets to protect people with whom they do business.

(7) Suspending the privilege of doing business as to agencies at public stockyards that are insolvent or guilty of violations of the law.

Experience has shown the necessity of having the law amended, and in a

general way the lines along which it should be amended, in order to meet some of the conditions with which we have had to deal, and a bill sponsored by the department and introduced by Chairman Haugen, of the House Committee on Agriculture, was approved by that committee covering principally the lines indicated in items 5, 6, and 7, above stated. The views of the Packers and Stockyards Administration are in accord with the statements made in the printed report of the committee. This bill had the support of the livestock producers' organizations, who also advocated amendments along some of the other lines indicated. The bill reached the House from the committee so late in the session of Congress, and so many other important bills were under consideration, that it was not acted upon and remained pending on the calendar when adjournment was taken in June, 1924. Anticipating this situation and as the act making appropriations for the department for the fiscal year 1925 was under consideration, a provision was proposed by Congressman Rubey and inserted by the House by a vote of 75 to 25 in the appropriation act which passed Congress. This provision as it passed is as follows:

*Provided*, That the Secretary of Agriculture may require reasonable bonds from every market agency and dealer under such rules and regulations as he may prescribe, to secure the performance of their obligations, and whenever, after due notice and hearing the Secretary finds any registrant is insolvent or has violated any provision of said Act, he may issue an order suspending such registrant for a reasonable specified period. Such order of suspension shall take effect within not less than five days, unless suspended or modified or set aside by the Secretary of Agriculture or a court of competent jurisdiction.

This is a proviso in the paragraph making the appropriation for the enforcement of the packers and stockyards act. Regulations are being formulated for the purpose of putting this authority into effect. As the legislation approved by the committee which was pending at the close of the session covers the subjects in this proviso more definitely and in addition other amendments necessary to strengthen the administration of the law, it is desirable that such legislation be passed at the next session of Congress.

From the beginning the Packers and Stockyards Administration has taken the position that livestock exchanges which perform dockage services are market agencies within the meaning



of the packers and stockyards act, but some of the exchanges have not registered or have refused to extend such services to cooperative selling agencies which were not members, while at the same time traders and packers who are not members were participating. Among such exchanges are the ones at Kansas City and Chicago. The case of the former is involved in docket No. 39. At Chicago request for such service was made by the Farmers Union Livestock Commission, a cooperative market agency not a member of the exchange. This request was refused by the exchange and the matter was submitted to the solicitor of the department and the Attorney General for legal opinion. While this was pending, the various proposed amendments to the packers and stockyards act were under consideration by the House Committee on Agriculture. Among these amendments was one to remove any question as to the legislative intention and the requirements of the law that livestock exchanges should render such services to non-members without discrimination. An alternative proposal was that power should be lodged with the Secretary of Agriculture to employ the dockers to render the service under reasonable regulation and to collect the cost. It is the view of the Packers and Stockyards Administration that it is in the best interests of all concerned in the marketing of hogs through public stockyard markets that hogs shall be docked under uniform conditions for all market agencies alike. Recently the Attorney General has decided that the Chicago Livestock Exchange is a market agency which is required to register and render its dockage service without discrimination, specifically upholding the request of the Farmers' Union. The administration is taking the necessary steps to carry this decision into effect.

In addition to these matters, the experience with the acquisition of the packing business of Morris & Co. by Armor & Co., and the resulting scrambling of the properties, indicates the desirability of serious consideration of the question whether such transactions should be allowed to proceed without restriction. As under the packers and stockyards act at present the Secretary can only institute a proceeding when the transaction has been or is in process of being consummated, and in such proceeding can not secure a stay until after the issuance of a final order and appeal to

the Circuit Court of Appeals, it is obvious that so much time may be consumed, as has been in the case in the hearings, and the process of scrambling may go so far, as to make the execution of the Secretary's order difficult and the protection of the public interest uncertain. In this connection, attention is directed to the existing provisions bearing on this general subject in laws regulating public utilities.

Our experience also indicates that consideration should be given to an amendment to section 203 of Title II of the act, which applies to packers, so that the Secretary of Agriculture will not be confined to proceedings based upon complaints which he formulates and issues, but may, in his discretion, proceed directly on the basis of bona fide complaints filed with him showing reasonable ground, and so that the complainant may then have the same right of appeal as the packer. Under Title III of the act, the Secretary of Agriculture may hear complaints filed with him as well as institute his own proceedings. However, in Title III, no provision is made for an appeal by the complainant and consideration might properly be given at the same time to a change in this regard.

#### ADMINISTRATION INVESTIGATED

It seems appropriate here also to refer to an investigation of the Packers and Stockyards Administration which took place during the year before the House Committee on Expenditures in the Department of Agriculture. During the first sessions of the hearings testimony was produced, which, apparently due to a lack of adequate information as well as to a certain amount of misinformation and prejudice on the part of witnesses who were called by one or two members of the committee, seemingly conveyed the impression that the packers and stockyards act had not been administered properly. When an opportunity was secured for the department to be heard at later sessions, officials of producers' organizations, which were said by the criticizing witnesses to have suffered injury and financial loss as a result of policies followed by the administration, appeared of their own accord before the committee and unqualifiedly voiced approval of the Packers and Stockyards Administration in its relations with them and their organizations. The



administration met all the criticisms specifically by the submission of the actual facts and justified its course of action on every question involved. The statements on these matters will be found in part 2 of the printed record of these hearings entitled "Hearings before the Committee on Expenditures in the Department of Agriculture, House of Representatives." The committee conducting this investigation, upon hearing the representatives of the Packers and Stockyards Administration, adjourned May 28, 1924, to meet at the call of the chairman, but no further hearings have been conducted, the committee has not sustained the charges, and it has made no report in connection with this investigation.

### CONFERENCES WITH LIVESTOCK INDUSTRY

It is the policy of the administration, founded on its own experience and the long-established general policy of the department, to confer freely and frequently through members of its staff with all classes of persons interested in the administration of the act, both directly and indirectly. Such conferences are sometimes purely local and at other times national in scope, sometimes on public announcements, at other times by invitation to specific groups or individuals, and often without prearrangement with individuals or groups who call for the purpose. Such conferences are exceedingly helpful. Among these was a two-day conference at the invitation of the Packers and Stockyards Administration, beginning May 15, for the purpose of securing clearly the producers' point of view on the principles and their proper application involved in yardage and feed charges at public stockyards. The following-named persons participated in their individual capacity:

John G. Brown, president, National Livestock Producers Association.  
 Henry A. Wallace, secretary, Corn Belt Meat Producers Association.  
 William Hirth, Missouri Farmers Association.  
 John Tromble, president, Kansas Farmers Union.  
 J. W. Greenleaf, Public Utilities Commission of Kansas.  
 L. J. Taber, Master, National Grange, Columbus, Ohio.  
 F. R. Marshall, National Wool Growers Association.  
 F. G. Ketner, Ohio Farm Bureau Federation.  
 T. W. Tomlinson, American National Livestock Association.  
 J. F. Reed, Minnesota Farm Bureau.  
 R. A. Cowles, Illinois Agricultural Association.

Through these discussions a more thorough understanding has been gained of certain perplexing problems and the point of view of producers regarding them, and their solution doubtless has been facilitated through consideration in this manner. The conference, on its own motion, adopted the following resolution with reference to stockyard charges:

The Packers and Stockyards Administration should permit the stockyards companies to formulate their general policies as to the manner in which rates should be made and distributed between the various sources of revenue, provided that the aggregate revenue, based upon such rates, does not exceed a reasonable return upon the fair value of the property and that the rates proposed are not unjust in their application as between the different classes of service affected.

Other conferences were held at various points in the field with central marketing interests and producers' representatives for the consideration of matters such as reweigh or second yardage charges, weighing up, string sales, open-market conditions, bonding and accounting requirements, etc., and general benefit resulted from this method of considering these important problems.

### SUPERVISOR SUMMARIZES ACTIVITIES

The following summary of things accomplished by the Packers and Stockyards Administration, prepared by one of the district supervisors, covers in a general way several of the administration's activities in which producers and shippers of livestock are interested:

Reduction of commission rates at leading western markets through arbitration proceedings, saving hundreds of thousands of dollars annually to shippers.

Actual physical valuation of stockyards' properties to furnish sound basis for determination of rates and charges (this work well under way).

Bonding all livestock commission companies to insure remittance to shippers of net proceeds of all livestock consignments sent to terminal markets.

Establishment of shippers' proceeds accounts by commission agencies, which keep intact all money received from the sale of livestock, thereby assuring payments to owners marketing the same.

Opening the way for farmers' cooperative selling agencies in the terminal markets, not by favoritism or

partisanship, but by standing squarely for the open-market principle at all markets.

Supervising feeds furnished in the yards, insisting on quality, and regulating prices charged.

Improvement of trading relations and market practices in many markets.

Supervision of all stockyards' scales, formulation of rules governing weighing operations, and requirement of frequent and thorough scale testing according to Government specifications.

Increased prices for dead animals at several terminal markets.

Assisting shippers to secure just settlements where disputes arose.

Securing better train service for livestock shippers through the cooperation of carriers, also distribution of refrigerator cars for packers and stock cars for producers of livestock.

Speeding up the unloading of livestock at terminal markets and eliminating as much as possible the crippling of stock.

Registering all buyers and sellers of livestock and requiring schedules of rates and charges which must be observed without discrimination.

Auditing the accounts of stockyard companies and commission firms and requiring correct returns for sales of livestock with all necessary information covering grading and selling of the same.

Penalizing registrants who violate the law or rules and regulations of the Secretary of Agriculture.

Requiring ample facilities and reasonable service of stockyard companies and the removal from the market of persons found guilty of dishonest or uncommercial practices.

Guaranteeing to the producer of livestock who might ship one car a year the same consideration and service as is accorded those who are on the market each week; in other words, endeavoring to have all transactions of buying and selling of livestock on the terminal markets carried on in an equitable and nondiscriminatory manner for the best interests of the producer of livestock.

### STAFF ORGANIZATION

As has been explained in previous reports, the work of the administration has not been separated into projects, but has been arranged as a matter of convenience in the assignment of duties into divisions according to subject-matter, as outlined below, showing

some of the personnel of the various divisions:

- (1) Administration :  
Stephen Bray, specialist in marketing livestock and meats, general assistant.  
George T. Ash, chief clerk.
- (2) Rates and practices :  
G. N. Dagger, agricultural economist.  
C. E. Miles, examiner, assistant.  
Hermann C. Henrici, chief valuation engineer.  
C. A. Briggs, livestock weight supervisor.
- (3) Audits and accounts :  
Arthur S. French, general auditor.  
William E. Fink, senior accountant, assistant.
- (4) Economics :  
Charles J. Brand, consulting specialist in marketing.
- (5) Law :  
Bayard T. Hainer, attorney.  
Lyman S. Hulbert, examiner, assistant.  
John C. Brooke, attorney.

### CHANGES IN ORGANIZATION

Several changes of an important character took place in the organization during the fiscal year, the principal ones of which are briefly mentioned.

Howard M. Gore, head of the trade practices division, resigned in the fall of 1923 to accept the position of Assistant Secretary of Agriculture. The trade practice division was later on combined with the rates, charges, and registrations division with a change of designation to that of division of rates and practices, and G. N. Dagger, previously in charge of the division of rates, charges, and registrations, now heads the combined division.

A committee of review has been organized, composed primarily of the heads of the divisions of rates and practices, audits and accounts, and law, with other heads of divisions as alternates, the functions of which are to review reports, consider methods of procedure, and make appropriate recommendations to the officer in charge of the administration in connection with alleged violations of the law. No formal proceeding is instituted or terminated except upon consideration and recommendation by this committee. This plan was adopted for the purpose of stabilizing the handling of these proceedings and securing adequate consideration from the points of view of all divisions concerned before action. It has been exceedingly helpful in improving the preparation and handling of such matters.

### ADMINISTRATION

The activities of this division during the fiscal year consisted of the usual



duties carried on under this phase of the work in the Washington office, and embraced general administrative supervision over the field offices. Matters of finance and personnel and administrative relations between divisions are handled under this head. The head of this division acts in charge of the administration in the absence of the Assistant to the Secretary.

### GEOGRAPHICAL DIVISIONS

For the purpose of administering the market supervision work, the country has been divided into four geographical divisions, which are subdivided into districts. The outline of these divisions and districts, together with the names of division and district supervisors, follows:

1. Western division: James Christensen, division supervisor, Denver, Colo.; District headquarters: Denver, Colo.; C. D. Ashmore, district supervisor; Los Angeles, Calif., C. H. Beauchamp, district supervisor; North Portland, Oreg., R. L. Lisle, district supervisor.
2. Central division: Frank W. Miller, division supervisor, Kansas City Mo.; District headquarters: Fort Worth, Tex., V. E. Foster, district supervisor, J. H. Ruff, supervisor; Kansas City, Mo., G. E. Butin, district supervisor, O. E. Dyson, supervisor, C. D. Boardman, field assistant; Omaha, Nebr., Charles F. Walker, district supervisor; Sioux City, Iowa, F. M. Greenleaf, acting district supervisor; South St. Paul, Minn., M. L. Haskell, district supervisor.
3. Northern division: Walter A. Williams, division supervisor, Chicago, Ill.; District headquarters: Buffalo, N. Y., James F. Gibbons, district supervisor; Chicago, Ill., L. W. Krake, district supervisor, M. Guillaume, supervisor; Cincinnati, Ohio, Robert C. Ashby, district supervisor; Indianapolis, Ind., A. W. Joy, district supervisor; National Stock Yards, Ill., Charles S. Jones, district supervisor; Pittsburgh, Pa., S. M. Price, district supervisor.
4. Eastern division: Theodore J. Perrin, division supervisor, Washington, D. C.; District headquarters: Nashville, Tenn., T. A. Geddes, district supervisor; New York, N. Y., F. J. Miller, district supervisor.  
Washington district handled by division supervisor.

Over 75 per cent of the livestock marketed through public stockyards is handled through the yards where these offices are located. Economy of time and travel expense has been effected by these assignments and the arrangement of these districts as to outlying markets. In all, 77 public stockyards in 32 States are thus supervised. Division and district supervisors are required to look after the informal handling of complaints and the solution of various local market

problems as far as this can be done in the field and without formal action by the Washington office of the department. The supervisors have more direct and constant contact with members of the trade than other officials of the administration, and often, through their familiarity with details, are in a better position to take action for the administration. In many instances it is found that a great number of difficult problems involving various kinds of trade practices can be handled successfully in an informal manner through the offices of the field supervisors, and where this is done the interested parties get action promptly and without technicalities, which promotes greater satisfaction, relieves the Washington office of unnecessary attention, and enhances the ability of the organization to deal with new problems.

As one of the important features of the administrative work, a meeting of division supervisors is held at intervals, usually three or four months apart, at some central point, where one or more representatives of the Washington office join them in the consideration of problems that warrant attention in this manner. Similar conferences also are held by division supervisors with their district supervisors. Meetings are also held from time to time by the accountants. Such meetings have been found very beneficial and exceptionally helpful in handling the affairs of the organization.

### RATES AND PRACTICES

#### AMALGAMATION OF DIVISIONS

Mr. Gore left the Packers and Stockyards Administration to become Assistant Secretary of Agriculture in September, 1923. On February 16, 1924, the division of trade practices was merged with the division of rates, charges and registration, and this division has since been known as the division of rates and practices, of which G. N. Dagger is in charge. Under this arrangement, the division supervisors have been made responsible for trade-practice matters arising in their respective divisions. This plan of the organization has been completed by the appointment of an eastern division supervisor, with headquarters at Washington. Whenever occasion demands, the division supervisors refer their problems to the head of this division for advice as to the course that they should follow in disposing of the matters involved.



### ORGANIZATION

Owing to the increase in the volume of work which has to be handled in this division, several new men have been added to the force. It is the aim in this division to have everyone familiar with the general work of the division and yet to place the responsibility for a definite part of the work upon each individual. Under the present plan one person reviews all stockyard tariffs which are filed and another person handles the tariffs of market agencies. The handling of registrations of market agencies and dealers and the reviewing of bonds of market agencies are also the special responsibility of one person. All valuations of stockyards properties are under the direction of the chief valuation engineer and all technical phases of weighing livestock are handled by the livestock weight supervisor. Problems which arise in connection with the handling of these matters are discussed with the head of the division from time to time so that there may be a complete understanding and agreement on all questions. Under this plan it has been possible for the division to handle much more expeditiously and effectively the work which has come to it.

### REGISTRATIONS

During the year new registration certificates were issued to 354 dealers, 91 commission men market agencies, and 89 other market agencies. There were received for cancellation the registration certificates of 248 dealers, 106 commission men market agencies, and 51 other market agencies. It is a difficult task to keep up to date the registrations at the various markets. On the larger markets registrants often retire from the market and no notice is given to the administration. The supervisors have cooperated fully with this division in endeavoring to keep the registrations up to date.

### BONDS

By order of the Secretary, on June 14, 1923, the general rules and regulations for the enforcement of the packers and stockyards act were amended so as to require the execution and maintenance of bonds by commission men. This regulation became effective September 1, 1923. Its object is to secure to the owner or consignor the prompt and faithful accounting for and payment of the proceeds of the sale of livestock handled on a commis-

sion basis. A certified copy of each such bond is required to be filed with the administration. In many cases market agencies had already executed bonds which complied with the requirements of the regulation. Many market agencies had no bonds. The supervisors at the various markets have given close attention to the enforcement of this regulation, and substantially all market agencies have complied with the regulation at this time. In a number of cases market agencies clearing their business through other market agencies have not filed bonds, but endeavor to have the bonds of the clearing agency cover all such transactions. The value of bonds has been demonstrated on several occasions where commission firms have failed. It is felt that through such a safeguard the public stockyards gain a distinct advantage in the eyes of producers and shippers as market places over other places not similarly safeguarded. Congress recognized this, as evidenced by the Secretary of Agriculture being granted authority in the agricultural appropriation act, passed late in the year, to require bonds of dealers as well as market agencies.

### STOCKYARDS

During the year the stockyards known as Bragg & Millsaps at Atlanta, Ga., was dismissed from jurisdiction. Four additional yards were posted and brought under the jurisdiction of the Secretary of Agriculture. The names and locations of the yards and the dates of posting are as follows:

Name	Location	Date of posting
Union Stock Yards.	San Francisco, Calif.	Dec. 3, 1923
Farmers National Stock Yards.	Muncie, Ind.	Mar. 5, 1924
Darnell Stock Yards.	Memphis, Tenn.	Apr. 1, 1924
J. K. Shippey & Bros.	Atlanta, Ga.	Apr. 30, 1924

Seventeen stockyards were investigated by the supervisors and reports thereon rendered. In some cases the yards were found not to come within the definition of a stockyard as defined in Title III of the packers and stockyards act. In other cases the determination of jurisdiction has not yet been made.

A list of stockyards subject to the jurisdiction of the Packers and Stockyards Administration at the close of the year follows:

Name of yard	City	Date posted
Western Stockyards Co.	Amarillo, Tex.	July 1, 1922
New Orleans Stock Yards (Inc.)	Arabi, La.	Nov. 1, 1921
Atlanta Union Stock Yards	Atlanta, Ga.	Do.
J. W. Patterson Commission Co.	do.	Apr. 1, 1922
J. K. Shippey & Bros.	do.	Apr. 30, 1924
Augusta Stock Yard Co.	Augusta, Ga.	Nov. 1, 1921
Union Stock Yard Co.	Baltimore, Md.	Do.
Union Stock Yard Co. of New Jersey	Benning, D. C.	Do.
Brighton Stock Yards Co.	Brighton, Mass.	Do.
The Buffalo Stock Yards	Buffalo, N. Y.	Do.
Foust-Yarnell Stock Yards	Chattanooga, Tenn.	Do.
Pursley Stock Yards	do.	July 1, 1922
Union Stock Yard & Transit Co. of Chicago	Chicago, Ill.	Nov. 1, 1921
Cincinnati Union Stock Yards Co.	Cincinnati, Ohio	Do.
Cleveland Union Stock Yards Co.	Cleveland, Ohio	Do.
Columb a Stock Yards	Columbia, S. C.	Do.
Drovers Union Stock Yards	Columbus, Ohio	Do.
Dallas Union Stock Yards Co.	Dallas, Tex.	July 1, 1922
Union Stock Yards Co.	Dayton, Ohio	Nov. 1, 1921
Denver Union Stock Yard Co.	Denver, Colo.	Do.
The Detroit Stock Yards	Detroit, Mich.	Do.
El Paso Union Stock Yards Co.	El Paso, Tex.	Do.
Independent Stock Yards	do.	Do.
Evansville Union Stock Yards Co.	Evansville, Ind.	Do.
Fort Wayne Union Stock Yards Co.	Fort Wayne, Ind.	July 1, 1922
Fort Worth Stock Yards Co.	Fort Worth, Tex.	Nov. 1, 1921
Fostoria Union Stock Yards Co.	Fostoria, Ohio	Do.
Belt Railroad and Stock Yards Co.	Indianapolis, Ind.	Do.
National Stock Yards	Jacksonville, Fla.	Do.
The Jersey City Stock Yards Co.	Jersey City, N. J.	Do.
Kansas City Stock Yards Co.	Kansas City, Mo.	Do.
East Tennessee Stock Yards	Knoxville, Tenn.	Do.
La Fayette Union Stock Yard Co.	La Fayette, Ind.	Do.
Union Stock Yard Co.	Lancaster, Pa.	Do.
Union Stock Yards	Laredo, Tex.	Dec. 1, 1922
Los Angeles Union Stock Yards Co.	Los Angeles, Calif.	Nov. 1, 1922
Bourbon Stock Yard Co.	Louisville, Ky.	Nov. 1, 1921
Marion Union Stock Yards Co.	Marion, Ohio	Do.
Memphis Union Stock Yards	Memphis, Tenn.	Do.
Dixie-National Stock Yards (Inc.)	do.	Do.
South Memphis Stock Yards	do.	Do.
Darnell Stockyards	do.	Apr. 1, 1924
Milwaukee Stock Yards Co.	Milwaukee, Wis.	Nov. 1, 1921
Union Stock Yards Co. of Montgomery (Inc.)	Montgomery, Ala.	Do.
Moultrie Stock Yards (Inc.)	Moultrie, Ga.	Do.
Farmers' National Stockyards	Muncie, Ind.	Mar. 5, 1924
Nashville Union Stock Yards (Inc.)	Nashville, Tenn.	Nov. 1, 1921
St. Louis National Stock Yards	National Stock Yards, Ill.	Do.
Newark Stock Yards	Newark, N. J.	Do.
New York Stock Yards Co.	New York, N. Y.	Do.
Union Stock Yards Co.	Norfolk, Va.	May 1, 1922
Portland Union Stock Yards Co.	North Portland, Oreg.	Nov. 1, 1921
Salt Lake Union Stock Yards	North Salt Lake, Utah	Do.
Union Stock Yards	Ogden, Utah	Do.
Oklahoma National Stock Yards Co.	Oklahoma City, Okla.	Do.
Pasco Union Stock Yards Co.	Pasco, Wash.	Do.
Peoria Union Stock Yards Co. (Inc.)	Peoria, Ill.	Do.
West Philadelphia Stock Yards Co.	Philadelphia, Pa.	Do.
Pittsburgh Union Stock Yards Co.	Pittsburgh, Pa.	Do.
Pueblo Stock Yards Co.	Pueblo, Colo.	Mar. 1, 1922
Richmond Union Stock Yards Co.	Richmond, Va.	Oct. 31, 1921
Southern Stock Yards Corporation	do.	Do.
Union Stock Yards	Roanoke, Va.	Mar. 15, 1923
Union Stock Yards, S. A.	San Antonio, Tex.	Nov. 1, 1921
Union Stock Yards, Butchertown Reservation	San Francisco, Calif.	Dec. 3, 1923
Union Stock Yards Co. of Seattle	Seattle, Wash.	Nov. 1, 1921
Sioux City Stock Yards Co.	Sioux City, Iowa	Do.
Sioux Falls Stock Yards Co.	Sioux Falls, S. Dak.	Do.
Union Stockyards Co. of Omaha (Ltd.)	South Omaha, Nebr.	Do.
St. Joseph Stock Yards Co.	South St. Joseph, Mo.	Do.
St. Paul Union Stockyards Co.	South St. Paul, Minn.	Do.
Spokane Union Stock Yards Co.	Spokane, Wash.	Do.
Springfield Union Stock Yards Co.	Springfield, Ohio	Do.
Inter-State Stock Yards Co.	Toledo, Ohio	Do.
Toledo Union Stock Yards Co.	do.	Do.
Wichita Union Stock Yards Co.	Wichita, Kans.	Do.
New York Central Stock Yards	West Albany, N. Y.	Do.



### STOCKYARD RATES AND CHARGES

The division has reviewed carefully all changes in tariffs which were filed. In the case of stockyard tariffs this involves the necessity of accumulating data on the market price of feed and reports of the auditing division on the financial operations of the various yards. Where increases have been allowed as a result of increases in market prices, corresponding reductions have been secured when the market prices have declined. The supervisors have also kept the division informed regarding the purchases and quality of feed bought by the various stockyard companies and also the quantities on hand from time to time. In numerous cases where increases in rates did not seem to be warranted by the facts, it has been possible to make adjustments without the necessity of formal proceedings. In other cases formal proceedings have been instituted. A number of formal hearings have been held relative to stockyard charges, and a record of these is shown in the digest of formal dockets. In this connection special attention is directed to the Peoria case, docket No. 5, in which the Secretary on June 30, 1924, ordered substantial reductions in both feed and yardage charges.

### RATES AND CHARGES OF MARKET AGENCIES

The arbitrators' award on the commission rates was rendered on July 24, 1923, and became effective September 1, 1923, at Chicago, South St. Paul, Omaha, and Kansas City. As shown elsewhere in this report, about half of the commission business of all the markets is done at these four markets. Adjustments with reference to the arbitrators' award were made by the market agencies without formal action by the Administration in Sioux City, St. Joseph, National Stock Yards, and Peoria.

A review of the record of the formal dockets in this report will show the formal proceedings relative to commission rates which are now in progress.

### VALUATION PROCEEDINGS

The work of valuing stockyard property, which had just started at the beginning of the year, has proceeded very rapidly under the direction of Hermann C. Henrici, chief valuation engineer. Valuation reports have been made on stockyard properties at Chicago, Pittsburgh, St. Paul, and Nashville, in addition to Peoria previously reported, and a valuation at Denver is

under way. The valuations in the Chicago, Pittsburgh, Nashville, and Peoria cases have been presented at formal hearings on the reasonableness of stockyard rates and charges. The magnitude of this work is slightly indicated by the fact that in the four cases in which hearings have already been held, the valuations as reported by the Government valuation engineers aggregated over \$16,000,000. Stockyards valuation for rate-making purposes is practically a new field in public utility regulation, and little by way of direct precedent is available. Consequently, an exhaustive study has been made of methods and conclusions applied by other bodies to public utilities and the state of the law has been considered with care. Definite policies are being charted out in the light of the views expressed in current court decisions, among which the hearing by the United States District Court at Peoria, in regard to the Peoria case, was helpful. In this case, three judges unanimously refused to grant an injunction against the Secretary of Agriculture, and thus put into effect substantial reduction in charges.

### SCALES AND WEIGHING

Progress has been made in the work started during the preceding fiscal year, under the direct supervision of a weight supervisor, in the improvement of stockyard scales and weighing. During the fiscal period just completed a specially qualified assistant was secured and stationed in the field with headquarters at South St. Paul to aid in the work. Special attention has been given to the matter of adequate tests with ample test loads, the suitability of the scales, and the methods of weighing.

In order that scale testing may be done on the most reliable basis the use of larger test loads is being provided for. This is necessary for insuring accuracy in weighing the heavy drafts required of livestock scales. This work, however, is being planned so that the necessary test loads can be provided at the minimum cost according to local conditions.

Scale-test forms have been prepared for the use of scale-testing agencies in recording the data of the tests. This insures a proper and systematic record of the tests as they are carried out. The forms are proving to be very satisfactory.

The subject of providing livestock scales suitable for the particular service demanded of them has been very



carefully studied. As a result there is being arranged a list of livestock scales from which proper selection can be made, which represents the best judgment and meets the approval of scale engineers, representatives of the scale companies, representatives of several of the stockyards who have given us the benefit of their ideas and opinions, and of the livestock weight supervisors of the Packers and Stockyards Administration. These scales will avoid the weighing of livestock on scales with unnecessarily large beams and the weighing of small loads on scales too large for the purpose and will result in other necessary improvements.

The check on the methods of weighing has been continued and in several cases unsatisfactory practices have been corrected. Weighing rules which meet the approval of those concerned have been prepared and are being observed by weighmasters at the important markets.

The general survey of the whole situation, started during the prior fiscal year, which included an examination of the weighing facilities at all the principal markets, has been continued through this fiscal year and has enabled the weight supervisors to take action which, through cooperation with the livestock market supervisors, has resulted in a noticeable improvement in this branch of stockyard services. Beneficial cooperation also has been given the administration by scale manufacturers and State officials, especially in connection with scale-testing work and in selecting scales most suitable for the kind of weighing performed.

The policy of the administration in this work is to secure and maintain accuracy in the weights obtained at the stockyards by impressing those directly responsible for the scales with the importance of making adequate tests as well as of securing proper construction, installation, and maintenance of the scales, and by endeavoring to bring about proper conditions with a minimum of change and expense.

The foregoing constitute only a few of the matters pertaining to scales and weighing to which it has been found necessary to give attention during the fiscal year, but they are the things considered fundamental in connection with the scales used for livestock weighing, and, along with these matters, attention also has been given to many minor things which, in the aggregate, influence the final results.

## OTHER ACTIVITIES

Members of the rates and practices division assist the examiners in getting ready for hearings and in the preparation of their reports following the close of the formal hearings. In so far as possible each person assists in the preparation of the reports on those cases involving the questions which concern his own part of the work. This cooperation between the members of this division and the examiners is mutually beneficial and has enabled examiners to expedite their reports to the Secretary. However, the reports of the examiners reflect their individual views which may or may not be adopted by the administration or the Secretary in the final decision after all exceptions and arguments are considered.

## TRADE PRACTICES

A large number of investigations and reports have been made by the auditing division disclosing possible violations of the packers and stockyards act and the rules and regulations issued thereunder. Many formal proceedings have been instituted as a result of these reports. These are reported in detail in the docket report. The violations set forth have to do with the rendition of incorrect account sales as to the name of the purchaser and the weight and price of the animals, departures from the schedules of rates and charges on file, and other practices which appear to be unfair or discriminatory. In many of these cases the registrants in question have filed signed admissions of the facts set forth in the notices and have waived oral hearing. In other cases hearings have been held, and in some cases it has been found that there was no actual violation. In all cases where the facts were admitted and oral hearing waived, and in cases where, after oral hearing, the charges were sustained, cease and desist orders have been issued.

In carrying on this phase of the work it is the policy of the administration to give the registrant a full opportunity to be heard in order that all the facts may be established and the requirements of the law and regulations fully understood. In many cases it was found that a registrant had engaged in practices which constituted a violation of the act and regulations through failure to understand or appreciate the requirements of the law or by reason of certain market practices which have grown up and become

a more or less fixed custom in the market. Usually when the attention of a registrant is called to these matters specifically, there is manifested promptly a willingness to follow in the future the course prescribed by the law and regulations.

When reports are received setting forth infractions of the law and regulations as to trade practices, it is the practice of the division to submit the report to the supervisor, if he has not already handled it, and obtain a report from him upon the practical aspects of the violations alleged. By this procedure it is possible to eliminate any apparent violations which can be explained satisfactorily and, in addition, enlist the confidence of the livestock industry in the desire of the administration to enforce the provisions of the act and regulations in a constructive manner. Under the committee of review system that has now been established there is a systematic attempt to confine the institution of formal proceedings to those which will result in the elevation of market practices to higher standards through definite disapproval of specific instances showing bad practices.

In addition to the reports made by the auditing division, there have been a number of complaints filed by various parties alleging unfair practices. In most cases these complaints have proceeded to formal hearings and proceedings are now pending. Generally these complaints allege discriminatory practices of various kinds. A number of the major problems involving trade practices without regard to specific violations have been handled informally through the offices of the division and district supervisors. This division endeavors to keep in touch with all investigations of these complaints and from time to time calls upon the supervisors making the investigation to report what progress is being made.

Supervisors have continued the work which already had been started with reference to the abuse of livestock, such as the use of clubs, prod poles, etc., with the result that abuses of this kind now seldom occur at any of the markets. This has resulted in obvious direct saving to owners of livestock, as well as an economic saving due to a reduction in the number of bruised and crippled animals.

#### DISCRIMINATION

Typical of the investigations which the administration is often required to make is the following:

The administration received a complaint from the office of a State official alleging that one of the large packers was discriminating in the prices paid for butter at certain of its local stations in that State. It was alleged that higher prices were paid for shipments by rail than for consignments delivered by the local producer. The local and division supervisors made an extended investigation and report, as a result of which a conference was held between representatives of the State, the various agencies engaged in buying cream, and the Packers and Stockyards Administration. While the facts indicated that in some cases the differential between the prices paid was greater than the cost of the freight, yet the inquiry disclosed that the prices appeared to be governed by competitive conditions. After a full investigation there appeared to be insufficient basis for formal proceedings.

Other activities referred to in the previous annual reports in connection with various trade practices were continued during this fiscal year. These included problems dealing with the open-market question, handling livestock, prices for reactors, bruised, crippled and dead animals, fraudulent practices of various kinds, and the usual number of miscellaneous matters affecting practically every phase of the administration's authority.

One of the most serious disturbances of open-market conditions that came to the attention of the administration was the discontinuance of trading relations in the fall of 1923 by other market agencies and dealers with the co-operative selling agencies at Kansas City. The unsatisfactory conditions came to a focus very abruptly, and strenuous informal attempts to restore the open-market condition, to which the cooperatives are entitled, were unavailing. Therefore, upon informal demands and written complaints from the cooperatives a formal hearing was promptly instituted and pressed through to conclusion as outlined in the description of docket No. 39 elsewhere in this report.

Conditions disclosed by such proceedings and their inevitably hurtful consequences are so detrimental to the market as a whole in which they occur and to producers generally without regard to any distinction between groups or organizations that every fair-minded man should do everything in his power to break them up and prevent their repetition, regardless of his particular business connections or affiliations. In particular, the fiduciary responsibility of a market agency de-



mands that he shall not subordinate to his private interests or controversy the right of his principal or patrons to have every reasonable advantage of price in the open market which may result from business relations with anyone lawfully in business in that market. If such controversy involves a supposed violation of the law by any other agency, an orderly way has been provided by law for its settlement. The imminent possibility of outbreaks of the kind discussed has brought prompt congressional support to the department in its effort to meet such conditions.

Trade-practice committees, the organization of which was explained in last year's report, have continued to function at a number of the leading markets with success. The organization of such committees also has been extended to other markets during this fiscal year.

#### PROPOSED REGULATIONS

In the course of the enforcement of the packers and stockyards act certain conditions have manifested themselves which have been the subject of considerable discussion. The question has often been raised whether certain corrective measures should be applied and whether specific rules and regulations could be promulgated to bring about the conditions desired. During the year additional rules and regulations were drafted in tentative form and submitted to the supervisors, stockyard companies, market agencies, dealers and producer organizations for their suggestions and criticisms. These proposed rules and regulations cover such subjects as string sales, weighing up, filling orders from consignments, double commissions, records of accounts of sale or purchase, scale tickets, operation and installation of stockyard scales, and inventories of stockyard properties. These rules were submitted for the purpose of getting as comprehensive a statement as possible from the entire industry as to their practicability. The question of promulgating such rules is now under consideration. Pending such action reforms in practices in such matters are being brought about rapidly in markets where conditions permit.

#### AUDITS AND ACCOUNTS

The division of audits and accounts completed its organization for livestock markets during the fiscal year and enlarged upon the Washington

personnel so that the statistical and financial information furnished by all market agencies could be put to a more useful purpose. This information has been tabulated and put into proper form for use when occasion demands.

A portion of this work is a compilation of quarterly reports furnished by each of the commission agencies on a uniform basis, the reports having been reviewed and segregated in convenient form for reference. The division audited and reported on the financial affairs of 650 old-line commission firms and 25 cooperative organizations doing business at 51 markets. These 51 markets received, during the year 1923, 98,800,565 head of livestock, which was 97.71 per cent of the total receipts of the markets at the 67 cities under the jurisdiction of the Secretary of Agriculture. The commission business was small at the remaining 16 cities, being handled in practically every case by the stockyard operators as a part of their total business. At these 51 markets there were 675 commission agencies of which 650 were "old line" and 25 cooperative. Not all of these 25 cooperatives were in operation during entire year as there were 8 that were not in business in the first quarter. At the 51 markets for all commission agencies combined, the selling commissions were \$23,749,298.28, and the buying and other commissions \$1,852,058.23, or a total of \$25,601,356.51. Estimating the remaining markets on the basis of their actual receipts of livestock as 2.29 per cent as above indicated, the total commission, for all agencies on all public stockyards markets were \$26,201,367.74.

Of these commissions, the 25 cooperative agencies received \$2,575,974.89. As 8 of these 25 cooperative agencies were not in business during the first part of the year 1923, a further analysis of their receipts has been made, which shows that for the first quarter of 1924 the 25 concerns received \$785,205.16 as compared with \$533,473.93 received by the 17 in the first quarter of 1923.

At the four markets for which commission rates were established by arbitration as elsewhere mentioned—Chicago, Kansas City, Omaha, and St. Paul—there were in all 259 commission agencies in 1923, with total receipts of \$13,327,505.48, or over half the total for all markets combined. Including these four markets, there were seven markets in all that handled a total commission business of more



than \$1,000,000 each, the total being nearly \$17,500,000, or two-thirds of the commission business for all markets combined. The other three markets were National Stock Yards, Ill., Sioux City, Iowa, and South St. Joseph, Mo.

The field organization of the division commenced early in the fiscal period to audit all livestock commission companies throughout the United States for the purpose of disclosing trade practices which constituted apparent violations of the packers and stockyards act. The auditing force was divided into groups and all of the concerns on 25 markets were reviewed for this purpose. This resulted in the disclosure of many practices which apparently constituted violations of the packers and stockyards act, and the results of this work were referred to the legal division for action. These disclosures consisted of such practices as making false account sales to shippers, showing erroneous prices and weights of livestock, assessing and collecting commission rates not in accordance with schedules on file, and, in some cases, the withholding of funds due the shipper. These discrepancies were discovered from a detailed review of the comparison of items shown on account sales furnished the shipper with scale ticket and other records showing the actual sale, and the work naturally necessitated a tremendous amount of detailed checking which, in most cases, of course, was without results disclosing violations. Owing to the amount of work involved, certain brief periods were used for this investigation, and if the audit did not disclose violations within these selected periods the work with that concern would be terminated. Otherwise, the magnitude of a complete check of all transactions would make it impossible with any force of reasonable size and expense to make any substantial progress in the entire field. When the work had progressed far enough on the records of any concern to disclose enough apparent violations which, if proved, would establish the fact that the objectionable practice had been definitely and consistently followed, the investigation of that particular concern also was terminated.

The division confined its local investigations of data pertaining primarily to rates and charges to four markets, namely, Oklahoma City, Fort Worth, Denver, and Portland. Data thus procured will be used in formal proceedings.

As a result of the financial investigation in the prior fiscal year, regulations providing for the segregation of funds belonging to shippers were made effective September 1, 1923, and considerable time has been spent by different members of the auditing division in instructing market agencies and the exchanges in the installation of the necessary accounts. It is fundamental that no fiduciary has a right to, nor can he safely, divert the funds of his principal to purposes other than the trust imposed. Shippers' proceeds do not belong to the market agency, and are not to be used without the consent of the owner, no matter how laudable the purpose may otherwise seem. The fact that the agency may consider it necessary to use such funds to finance other enterprises in the livestock commission business is no justification. Progress has been made in all markets toward the complete establishment of a system of accounts which separates funds belonging to livestock shippers from personal funds of a market agency, and the system is giving satisfaction wherever it has been adopted. All markets, with the exception of Denver and one of two similar markets, have installed these accounts, and installation at these markets has been promised by the market agencies in the very near future.

The division has assisted in the valuation work of the rates and practices division by auditing the books of certain stockyard companies whose physical assets were being valued by the valuation engineer. The auditing feature of this work requires primarily a review of the books to procure costs of physical assets for use in connection with the valuation of the appraisal engineer and for the purpose of determining future income and expenses. This work includes the introduction of these audits as testimony in valuation hearings for future consideration.

Financial audits were made and statistical and financial reports were obtained for 58 stockyard companies, and the amounts segregated into the different classes of income and expenditures on the records of this division.

Requests were made for financial statements for the year 1923 from all concerns which, according to the best information available, are packers within the purview of Title II of the packers and stockyards act. Of these, 493 concerns made reports in such form as to be capable of use by the administration. The information

thus obtained is more nearly complete than that furnished for 1922 and the packers are evidently becoming more accustomed to the requirements of the Packers and Stockyards Administration as to such reports.

Consideration of data pertaining to the Armour-Morris merger case has required detailed investigation by members of the division of audits and accounts. A complete review of the profit and loss statements and financial condition of Armour & Co. and Morris & Co., prior to the consolidation, was made by the auditors in the early part of the fiscal year and the work summarized for use by the attorneys in their consideration of this aspect of the case. In the latter part of the fiscal year Armour & Co., having submitted certain exhibits pertaining to the accounting records as evidence in their part of the case, this division reviewed these exhibits with the book records for the purpose of verifying the accuracy of the information shown in the exhibits.

#### MANDAMUS CASE AGAINST PACKERS

It is obvious that there are many matters pertaining to the packing industry of a controversial character in which the public is interested that can only be determined authoritatively through an examination of the books of the packers by disinterested and competent Government accountants. It has, therefore, been deemed important that the Packers and Stockyards Administration gain access to the books of the packers and gather therefrom information pertaining to their operations. In this connection, the question of uniform accounting has also been given serious consideration. Although the department was desirous of gaining access to the books of the packers from the inception of the formation of the Packers and Stockyards Administration, great difficulty was experienced in securing for all the classes of work in view the services of a sufficient number of competent accountants within the department's ability to pay. Demand arose, immediately following the passage of the packers and stockyards act, that commission and stockyard rates and charges be investigated together with certain trade practices at the stockyards. Consequently, as rapidly as auditors could be obtained, their services were required for such work and the auditing division was not in a position immediately to begin an examination of the books of packers. How-

ever, plans were made with this object in view.

In the meantime the Packers and Stockyards Administration took up the matter informally with various representatives of the packing industry with a view to paving the way for cooperation which would facilitate the work. The real difficulty of carrying on such a project without any assistance or cooperation from the packers' accountants can only be appreciated by one who has some idea of the ramifications of the business of a large packer with its hundreds of departments and branches and the multitude of processes and accounting items, together with the technical meaning of terms used and the basis for arriving at many apparently arbitrary figures. This is emphasized by the fact that no two systems are exactly alike but each is the result of evolution in the particular business to which it relates. While these negotiations and the other work were under way the business of Morris & Co. was acquired by Armour & Co., and as these were two of the largest packers it was necessary to divert a part of the accounting force to the study of that transaction by examination of their books and records and the compilation of information from other sources. Finally, however, it became apparent that the other big packers would not allow the administration's accountants to examine their books and records unless they were compelled to do so. Therefore, in November, 1923, formal notices were served on Swift & Co., the Cudahy Packing Co., and Wilson & Co., demanding access to and opportunity to examine the accounts, records, and memoranda of these packers for specified purposes. These demands were refused, and the foundation having thus been laid, mandamus proceedings were instituted by the Department of Justice at the request of the Secretary of Agriculture against the packers named in the United States District Court for the Northern District of Illinois at Chicago. The omission of Armour & Co. and Morris & Co. in this proceeding was because they were already parties to the merger proceeding in which we had access to their books.

Counsel for the packers, following the institution of the proceedings, obtained from the court an allowance of a considerable period of time for making defense to the petition for writs of mandamus and finally submitted to the court a motion to dismiss the peti-



tions on the ground that the court did not have jurisdiction to issue writs of mandamus under the packers and stockyards act. In time the three cases came on to be heard. The Government was represented by Judge Hainer, of the Packers and Stockyards Administration, and on June 28 Federal Judge Cliffe announced his decision to the effect that the court had jurisdiction to issue writs of mandamus in these cases, and, consequently, overruled the motion to dismiss the petitions of the Government. He also held that he was satisfied that, on the merits of the question, the Government was entitled to the issuance of writs of mandamus and directed their issuance, subject to appeal from his action by the defendants. Subsequently, the defendants were allowed to file answers to the petitions, and the three cases were set for hearing at Chicago on September 26, 1924, on their merits.

### ECONOMIC

The economic division of the administration has had many matters under consideration during the year. They have related both to questions more directly concerned with enforcement of the act and to problems of an economic character bearing on the welfare of the industry in its effect on the people generally and on national policies. This report covers some of the major activities.

### DEPRESSION IN LIVESTOCK INDUSTRY

Partly in cooperation with the Bureau of Agricultural Economics, the consulting specialist in charge has devoted considerable time to investigation of fundamental legislative and economic conditions affecting prices of livestock and the purchasing power thereof in terms of other commodities both agricultural and nonagricultural. Many persons expected profound effect on prices from legislation regulating livestock distributing agencies and concerns engaged in the processing and distributing of livestock and meat products.

While good success have been obtained in the correction of abuses and the improvement of practices, it is becoming clearer to producers and others concerned that corrective measures confined in their application to productive and purveying functions whether of raw or finished materials will not alone restore the livestock industry to the normal and healthy condition that prevailed prior to the war.

During the war an unbalanced productive situation was created not restricted to the United States. This must be corrected with a subsequent stabilization of values in terms of purchasing power before material and settled improvement can be counted on. Just at the close of the fiscal year price improvements began to appear in both livestock and grain prices. This was not due to the passing away of artificial factors causing disparity. It was caused rather by unfavorable crop factors and decreased production of livestock forced by money losses.

In 1923 a rather general belief prevailed that grain farmers, and among these wheat growers in particular, were about the only remaining sufferers from the depression of agriculture that began in 1920 and that still prevailed largely on June 30, 1924. That in fact hog and cattle growers were still under a crushing burden was amply shown, and assistance was given the committees of the Congress in preparing legislation intended to afford general relief.

Particular study has been given to the effect on domestic price levels of surpluses available for export. In the case of edible products of beef cattle the evidence showed that foreign prices and conditions practically control domestic prices of the whole production even when the percentage exported constitutes less than 2½ per cent of such whole. This statement of course is subject to qualification to the extent that domestic influences may disturb conditions and prices within this country. In the case of hogs, by reason of the importance in the export trade of their major products, bacon, hams, and lard, the domestic price determining power of the world market is even greater. In the cases of these it may almost be said that we are the great source of supply for the nations that are deficient in production. As a result, although we export in effect only about one hog in ten of our total annual marketing, that one affects the price of the whole ten.

The investigations made have also demonstrated amply that the trouble does not lie in the dollar prices prevailing in American markets, although these are affected by world conditions. The average price of live hogs per hundred at Chicago during the 10-year pre-war period 1905-1914 was \$7.10. The month of February, 1924, when it was \$7.08, is the first time, with the single exception of March, 1915, since February, 1912, that the average price



of hogs for any month has been below the average for the 10 pre-war years. Prices as low as \$5 and even \$4.70 occurred between 1905 and 1909. As the average annual prices for 1921, 1922, 1923, and the first seven months of 1924, when the depression was at its worst, were \$8.68, \$9.56, \$7.77 and \$7.47, respectively, it is evident that price in and of itself does not explain the losses of the hog grower.

In a word, the trouble is not that the farmer now gets too few dollars for what he sells, but that even more dollars than he used to get are not enough to supply his needs because he has to pay so much more for the goods he requires for the conduct of his business and in his living.

This work has involved not only a wide range of field investigation and statistical study of production, movement, prices, and export trade, but also analyses of legislative and economic programs past and present of other nations.

#### **ECONOMIC PHASES OF THE ARMOUR-MORRIS MERGER CASE**

The work in respect to this case, our docket No. 19, has involved attendance at hearings, the reading of over 10,000 pages of testimony, the examination of hundreds of statistical and other exhibits in the form of graphs, tables, and textual offers, and the preparation of material intended to sustain the contentions of the Government from the economic side of the controversy.

In a record so long involving an industry so widespread and important, many questions of public policy and economics arise, all of which require such development based on facts as can be adduced for judicial consideration. In addition to fact evidence, much important evidence is left in the realm of expert opinion and deduction. Much attention has been given this latter phase of the case by the Economics Division.

The great question at issue in this case is the effect on competition in interstate commerce of the acquisition by Armour of the whole physical properties and business of Morris. Prior to the purchase there was a group known as the Big Five that occupied a dominating position in the industry. Now there is a so-called Big Four, which is a misnomer. Armour, formerly second in size to Swift, through buying Morris in 1923, theretofore the third largest American packer, became the largest in volume of business.

We now have and will have in the future, unless the merger be dissolved, not a Big Five or a Big Four but a Big Two doing nearly 48 per cent of the interstate slaughtering business, a Middle Two doing a little over 13 per cent, and all the rest of the Federally inspected slaughterers combined doing something more than 39 per cent of the total business.

A study of the effect of the merger on competition in the buying of livestock and in the sale of meats and other products has involved, among others, consideration of the following problems: The relation of farm and other intrastate slaughter to competition in interstate commerce; what percentages of the total business would be necessary under one centralized control and under varying situations to effect such lessening of competition either locally or generally as falls under the prohibitions of the packers and stockyards act; the extent to which prices of livestock at public stockyards go up or down with lessening or increasing receipts; the relations between prices of live animals and their edible products at both wholesale and retail; the extent if any to which the Government action during the war was responsible for existing economic conditions of producers and packers; the extent to which receipts of stocker and feeder cattle should be considered in the problem of measuring competition as the determiner of prices of meat animals; the relation of local packers doing an interstate business to competition in the national field which is admittedly dominated by the "Big Two" and to a smaller extent by the "Middle Two" and a few of the more important so-called independents; the extent to which the speculator constitutes real competition for the buyer in view of the fact that within a few hours or a few days at most he must sell to the very packers against whom he is supposedly supplying effective competition; the ultimate effect of business failure on competitive conditions; and the effect of well-established market practices on competition such as the so-called cleaning up of the market by the large packers, and the disclosure to later prospects of bids previously made by former prospective buyers.

The foregoing indicates the character of the necessary work. It is not a complete listing. These activities will be considerably intensified during the new fiscal year.

### RETAILING BY MEAT PACKERS

The most efficient and low cost transfer of raw material to processor and of finished goods to the consumer, is the economic duty of market agencies, dealers, packers, wholesalers, and retailers to the livestock and meat industry. These instrumentalities are not performing their functions to the public nor to the trade of which they are a part, when methods likely to be less expensive, less wasteful, more direct, resulting in delivery of better product to consumers, and in ability to pay slightly higher prices to producers are either ignored or waved aside because of mere difficulties or fancied reasons of selfish protection. Similarly, opposition on the part of producers and consumers to changes intended to improve distribution methods is unwise and indefensible when it emanates from either fear or destructive motives.

Originally, the packer was merely a killer and processor. Later, wholesaling which had been done almost wholly by independent enterprises was taken over. With the advent of the refrigerator car, certain functions a part of or closely related to transportation were taken over to a large extent. The next step was the development of the branch-house system which practically carried packing-house goods to the retailer's door. Later and most recent in origin came the peddler car or car route, and interurban motor-truck deliveries. So now we have in the case of meats one of the shortest existing routes from production to consumption, namely, grower, packer, retailer, consumer.

The retailer performs functions that can not be dispensed with. By reason of the composition, organization, and nature of the retail trade, it is relatively inefficient and adds the largest single charge to the price spread. As a result, improvement at this step in distribution may save more than at any other. Fear has been expressed that packers, especially the great ones, would dominate the food supply of the Nation to such an extent as to constitute a menace if they became engaged largely in retailing. The investigations of which this is merely a partial report have as one of their purposes a determination of the extent, if any, to which Governmental supervision would be effective and should be applied if this further step in the integration of the industry takes place. It is a safe principle that no regulation should be applied unless

really promotive of the industry and the public welfare. Investigations in 1923 in the United Kingdom disclosed one of the largest British international packers successfully conducting a chain of about 2,600 multiple shops. Preliminary investigations among a few of the smaller of our packers that operate retail chains and among chain groceries that conduct meat departments indicate that the next step in improved distribution of meat must come from packer retailing.

In this connection it is necessary to observe that the packer consent decree, entered by the Supreme Court of the District of Columbia in the case of the United States, petitioner, *v.* Swift & Co., et al., defendants, enjoins the remaining four of the five large companies that were parties to this litigation perpetually from engaging in meat retailing in the United States, either directly or indirectly. It should further be stated that the largest packing companies are opposed to any suggestion that it would be in the public interest for them to own and operate retail markets.

### BACON EXPORT TRADE PROMOTION

As a by-product of his various activities in behalf of the livestock industry, the consulting specialist in charge was requested by a voluntary group of hog producers, packers, and State agricultural and farm organization officials to serve as chairman of a temporary organization and later of a standing committee to devise and put into effect a plan under which those American hog growers whose situation warrants their participation therein may share with Irish, Danish, and Canadian producers in the high-priced export market of Great Britain. The tentative plan of procedure outlined to and adopted at the conference of interested parties in Chicago during the International Live Stock Show last December involves—

(1) A rather strict confining of the plan to certain States, namely, North Dakota, Minnesota, Wisconsin, and New York, and to those particular sections in these States where dairying, small grain production, and other factors give sound reasons for expecting the plan to succeed.

(2) The adoption by producers as far as possible in the form of organized export bacon-producing communities of the best export bacon-type breed, preferably the Yorkshire, though a few favored the Tamworth.



(3) The arranging of cooperation with State animal husbandry and extension forces to conduct the needed supervisory and educational work, particularly on the breeding and feeding sides of the plan. Properly balanced rations, using not to exceed 50 per cent of corn, and a suitable combination of small grains, skim milk, and other feedstuffs, were recognized as necessary to produce the hard type of fat which is found in both Irish and Danish export bacon.

(4) A more complete solution by the packers that will cooperate, of the curing problem in connection with transportation in order that American export bacon of the Wiltshire or Cumberland type may be placed on the British consumers' table in that mild state of cure which he prefers.

(5) The providing of additional compensation to those producers who take up the plan. Extra expense, extra care and additional labor and risk are involved. This is to be covered by a fixed premium for the carcasses that meet the export specifications. Participating packers will agree in advance to the schedule of premiums, the methods of determining who are entitled to them, and the length of time during which this method of encouragement shall be resorted to.

(6) The adoption of a master brand name under which in addition to the house brand of the several packers all high class bacon of the export type under discussion will be marketed.

(7) The arranging of a grading and inspection system suited to the needs of our situation, and similar to that in force for maintaining the "Lur" brand in Denmark.

(8) Steps to increase the consumption of this type of bacon in the domestic market.

This work is being done in cooperation with the National Service Association, certain breed associations, packers engaged in the bacon export trade, State agricultural authorities, and the Bureaus of Agricultural Economics and Animal Industry.

The standing committee is composed of Charles J. Brand, chairman; Lloyd S. Tenny, representing the Bureau of Agricultural Economics; K. F. Warner, representing the Bureau of Animal Industry; E. N. Wentworth, representing the Institute of American Meat Packers (T. U. Ellinger, alternate); A. F. Sinex, representing the National Service Association; and J. H. Shepperd, North Dakota Agricultural College, representing the

State agricultural forces by the selection of those represented at the meeting in Chicago, December, 1923.

#### COMPETITION IN FERTILIZER INDUSTRY

At the request of the Missouri Farmers Association, a preliminary investigation was made of competitive conditions in the sale of fertilizers. This work related more particularly to conditions in the State of Missouri with reference to treatment accorded co-operative organizations as compared with other purchasers. Although an unsatisfactory situation was found, no evidence of collusion or other unlawful practices was found.

#### LAW

During the past year the work of the legal division has been heavy. In this connection, attention is called to the "formal docket" report which indicates a substantial part of the work of this division.

One hundred and twelve formal proceedings have been instituted by the administration, 65 of which have been disposed of, leaving 47 still pending. Eighty-seven of these formal complaints were issued during this fiscal year, of which 52 were disposed of and 35 are among those pending. Aside from the preparation or review of complaints and the holding of hearings, the preparation of orders and other formal legal documents, this division is called upon for advice concerning many questions of a legal character arising in connection with the work of all the other divisions of the administration, described elsewhere in this report.

A great deal of legal work has been required, in connection with the Armour-Morris merger proceedings, which is discussed under docket 19. The substantial upholding in the Federal court of the order issued by the Secretary in the case at Kansas City, Mo., involving discrimination by certain of the old-line commission concerns and traders against the Producers' Commission Association, involved much work on the part of this division. This matter is discussed under docket 39.

The mandamus case instituted in the Federal court at Chicago by the Government under the packers and stockyards act against Swift & Co., Wilson & Co., and the Cudahy Packing Co., for the purpose of securing access to their books, was handled successfully by the legal division. It required a large amount of research



work, aside from the handling of the case in court.

Many questions of a legal character have arisen with respect to the bonds which market agencies have been required to execute, in pursuance of our bond regulations. There have been several failures of market agencies and considerable legal work has been done in this connection for the purpose of safeguarding the rights of shippers. Important questions of a legal character have arisen in connection with the valuation of the stockyards subject to the jurisdiction of the packers and stockyards act for rate-making purposes. Much work has been done in reviewing organization papers, proposed business methods, and rules of market agencies, and attending conferences with them on these matters. A considerable portion of the time of every member of this division, as well as other members of the administration, is devoted to the difficult and responsible task of presiding as examiners and participating as counsel in the contested formal proceedings under the packers and stockyards act and the cases that have been heard in court. Thus, for example, Judge Hainer has participated as Government counsel and the Assistant to the Secretary has presided over more than 75 days of actual sessions with more than 11,000 pages of record in the Armour-Morris proceedings since the beginning of the hearings at Kansas City on April 30, 1923. These sessions have been at Kansas City, East St. Louis, Omaha, Chicago, Denver, New York, and Washington. The hearings in the docket No. 39 at Kansas City lasted through a period of more than a month, with Mr. Hulbert of this division in active charge. Likewise, Mr. Brooke, of this division, and Messrs. Dagger and Miles, of the rate division, have had a number of difficult formal proceedings to handle. Exact-ing work in preparing for such proceedings and testifying as witnesses in them has fallen to members of all divisions including particularly accountants and supervisors. Thus, valuable experience and a high degree of coordination and versatility is being developed throughout the organization, which will greatly facilitate the work in future. It will be observed that within its field the Packers and Stockyards Administration combines authority substantially similar to that of the Interstate Commerce Commission and the Federal Trade Commission. Many opinions have

been rendered and much work done in connection with the current correspondence and problems of the organization.

#### FORMAL DOCKETS

In addition to cases originating during this fiscal year, this report includes also all cases that were pending at the close of the fiscal year ending June 30, 1923.

Docket No. 5. The Peoria Union Stock Yards Co., Peoria, Ill., Respondent:

This case involved the rates and charges of the Peoria Union Stock Yards Co. On June 30, 1924, the Secretary of Agriculture, following hearings, issued an order requiring the respondent to cease and desist from publishing, demanding or collecting any rate or charge for yarding livestock in the Peoria Union Stock Yards in excess of the following:

	Cents per head
Cattle .....	22
Calves .....	11
Hogs .....	7½
Sheep .....	6
Horses .....	22

The previous charges of the stockyards company for yarding livestock were as follows:

	Cents per head
Cattle .....	30
Calves, 300 pounds or under .....	15
Hogs .....	10
Sheep and goats .....	8
Horses and mules .....	30

The respondent was further ordered to cease and desist from publishing, demanding or collecting any rate or charge for feed in excess of the current market price of feed delivered to it plus the following margin for each kind of feed:

	Cents
Corn per bushel .....	39
Hay per hundred weight .....	58
Oats per bushel .....	23
Straw per hundred weight .....	48

This results in a substantial reduction in the rates and charges of respondent; which was further ordered to keep a true account of all changes in and additions to its physical property, including the dates, costs, and a description thereof, as a part of its records. It was also ordered that reparation be allowed the complainant upon proper showing in accordance with Title III of the packers and stockyards act. Since then an attempt was made by the stockyards company to obtain an injunction from the Federal court, which was refused, the court sustaining the Secretary's order

in all respects, except as to the yardage for hogs, which it increased to 9 cents instead of 7½ cents as ordered by the Secretary.

Docket No. 6. The Union Stockyards Co. of Omaha (Ltd.), South Omaha, Nebr.  
Docket No. 7. The Union Stockyards and Transit Co., Chicago, Ill.:

Each of these dockets involves the rates and charges of the stockyards in question. On June 22, 1923, the Secretary of Agriculture issued orders to the effect that certain rates and charges of each of the stockyard companies were discriminatory. During the past year the stockyards at Chicago have been valued by engineers of the Packers and Stockyards Administration and hearings have been held with respect to the valuation of that stockyard for rate-making purposes. The examiner has prepared tentative findings of fact and the stockyard company has been given time within which to file exceptions thereto. A material difference between the valuations claimed has appeared, the settlement of which is vital to the rates fixed, as the stockyards company is claiming in the neighborhood of \$33,000,000 against the Government valuation of about \$14,000,000. Action in docket No. 6 has been deferred pending the final decision in docket No. 7.

Docket No. 9. The American National Livestock Association et al. v. The market agencies operating at the stockyards at North Portland, Oreg.:

This case involved the reasonableness of the rates and charges of the market agencies concerned. The books of all of the commission men involved have been audited during the past year and a hearing will be held on July 21, 1924.

Docket No. 10. The American National Livestock Association v. The market agencies operating at the stockyards at Fort Worth, Tex.:

The books of the market agencies concerned have been audited, hearings held and the examiner has issued tentative findings of fact, proposing new rates reducing the general level of the charges at the market.

Docket No. 15. The American Commission Co. et al., Denver, Colo., respondents:

This case involves the reasonableness of the commission rates of the market agencies at Denver, Colo. The books of all of the market agencies there have been audited and the matter set for a hearing on July 25, 1924.

Docket No. 16. The Union Stock Yards & Transit Co. of Chicago, Ill.:

This case involved an increase in the charges made for corn. Inasmuch as the general question of rates and charges on this market was under consideration in docket No. 7, this case was merged therewith.

Docket No. 19. Armour & Co. of Illinois, Armour & Co. of Delaware, J. Ogden Armour, Morris & Co., and the North American Provision Co., respondents:

The object of the complaint is to determine the validity of the acquisition of the properties, business, and good will of Morris & Co., the third largest packer in the United States, by Armour & Co., the second largest packer. The hearings commenced on April 30, 1923, have been continued from time to time throughout the present fiscal year. Hearings have been held at Kansas City, East St. Louis, Omaha, Denver, New York, Washington, and Chicago. Several hundred witnesses from all branches of the industry have been examined, a large number of exhibits have been introduced in evidence and the record to date covers about eleven thousand pages. The hearings will be resumed on September 2, 1924, with the probability of early conclusion thereafter.

Docket No. 24. The Pittsburgh Stockyard Co., Pittsburgh, Pa., respondent:

This case involves the reasonableness of the rates and charges of the stockyard company. Engineers employed by the Packers and Stockyards Administration have valued the property of the stockyard company for rate-making purposes. On March 25 and 26 a hearing was held in the matter and tentative findings as to the facts are in the course of preparation by the examiner.

Docket No. 25. The Michigan Central R. R. Co., Detroit, Mich., respondent:

This case involves the reasonableness of the rates and charges at the stockyards at Detroit, Mich. On September 10, 1923, a hearing was held in the matter. The examiner has prepared tentative findings as to the facts and the respondent has filed exceptions thereto and the matter is set for argument before the Secretary on July 21, 1924.

Docket No. 26. The New York Central R. R. Co., respondent:

This case involves the reasonableness of the stockyard charges at Buffalo, N. Y. A hearing was held September 13, 1923, and the examiner prepared tentative findings as to the facts which were submitted to the re-



spondent. Subsequently the findings as to the facts were suspended and a further hearing held April 10, 1924. The examiner's report is in process of preparation.

Docket No. 27. In re Chas. H. Shurte, Chicago, Ill., respondent:

On June 27, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had failed to account to certain shippers for the entire proceeds received for their livestock and that he had rendered incorrect account sales and had failed to charge commissions in accordance with his schedule in certain instances. A hearing was held on July 9 and 10, and on September 29, 1923, the respondent was ordered to cease and desist from sending out incorrect account sales and from failing to adhere to his schedule.

Docket No. 28. In re Prouty Commission Co., South St. Paul, Minn., respondent:

On September 7, 1923, the Secretary of Agriculture issued a complaint against this respondent, alleging that it had issued incorrect account sales in certain instances and that it had overpaid one shipper and underpaid another. Respondent admitted the truth of the allegations and a cease and desist order was issued on December 29, 1923.

Docket No. 29. In re Percy Vittum Co., South St. Paul, Minn., respondent:

On September 7, 1923, the Secretary of Agriculture issued a complaint against this respondent, alleging that it had issued incorrect account sales and that it had underpaid certain shippers. Respondent admitted the truth of the allegations and a cease and desist order was issued on January 3, 1924.

Docket No. 30. In re W. M. Campbell, South St. Paul, Minn., respondent:

On September 7, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had issued an incorrect account sale. Respondent admitted the truth of the allegations and a cease and desist order was issued on October 2, 1923.

Docket No. 31. In re Chandler-Kost & Co., South St. Paul, Minn., respondent:

On September 8, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had issued incorrect account sales and had failed to account to shippers for the entire proceeds received from the sale of their livestock. Respondent admitted the truth of the allega-

tions and on October 2, 1923, a cease and desist order was issued.

Docket No. 32. In re South St. Paul Commission Co., South St. Paul, Minn., respondent:

On September 8, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had issued incorrect account sales and had failed to account to certain shippers for the entire proceeds received from the sale of their livestock. Respondent admitted the truth of the allegations and on January 10, 1924, an order to cease and desist was issued.

Docket No. 35. In re Smith-Burrows & Co., South St. Paul, Minn., respondent:

On September 8, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had issued incorrect account sales and had failed to account to certain shippers for the entire proceeds received from the sale of their livestock. Respondent admitted the truth of the allegations and on October 2, 1923, an order to cease and desist was issued.

Docket No. 36. In re United Commission Co., South St. Paul, Minn., respondent:

On September 12, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had issued incorrect account sales and had made overpayments to certain shippers. Respondent submitted an explanation and after a full investigation the case was dismissed on May 9, 1924.

Docket No. 37. In re C. L. Kaye & Sons (Inc.), South St. Paul, Minn., respondent:

On October 11, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had rendered incorrect account sales and had charged less than its published tariff for selling livestock. Respondent admitted the truth of the allegations and an order to cease and desist was issued on January 30, 1924.

Docket No. 38. In re Sol Hartman, trading and doing business under the name of Hartman Commission Co., La Fayette, Ind., respondent:

Following a hearing in this proceeding, the respondent continued to do business as a market agency after he was advised by the supervisor, the examiner, and the respondent's attorney that he should file with the Secretary of Agriculture his tariffs as required by law, and on May 6, 1924, the department referred this case to the Department of Justice for appropriate action.



Docket No. 39. In re Alexander, Conover & Martin Bros. et al, Kansas City, Mo., respondents:

On October 13, 1923, the Acting Secretary of Agriculture issued a complaint in which it was alleged that certain market agencies and dealers operating in the Kansas City Stockyards were discriminating against the Farmers Union Livestock Commission and the Producers Commission Association, cooperative agencies, in the buying and selling of livestock in said stockyards. After the holding of extensive hearings the Secretary of Agriculture found that the market agencies and dealers in question were discriminating against the Producers Commission Association in the purchase of cattle in said stockyards. Prior to the conclusion of the hearings, the Farmers Union Livestock Commission entered into an agreement with the Kansas City Livestock Exchange, the Traders Livestock Exchange, and the Kansas City Stockyards Co., through which it obtained the privilege of the dockage facilities, clearing house and blanket insurance of the livestock exchange, and the resumption of trading relations, and therefore withdrew from the proceedings. The Secretary of Agriculture on April 19, 1923, issued an order directing the market agencies and thirty dealers to cease and desist from discriminating against the Producers Commission Association in the purchase of cattle in said stockyards. The market agencies in question were further ordered to admit the Producers Commission Association to the use of the clearing house and the benefits of the so-called blanket insurance. The Secretary of Agriculture reserved all questions with respect to the matter of hog dockage. Subsequently the market agencies named in the order issued by the Secretary applied to the District Court of the United States for the Western District of Missouri for an interlocutory injunction to restrain the enforcement of the order issued by the Secretary. The case was heard, and on May 21, 1923, Circuit Judge Stone and District Judges Van Valkenberg and Reeves decided unanimously that in this proceeding the Secretary of Agriculture was acting within the powers lawfully granted him by Congress and within the evidence before him in promulgating his order that the market agencies in the Kansas City market cease and desist from violating the packers and stockyards act, 1921—

(1) By failing or refusing to buy cattle from the Producers Commission Association in the ordinary course of business or to enter into any business relations with it with respect thereto while at the same time engaging in and carrying on business freely among themselves; (2) by combining or agreeing among themselves to refrain from buying or to refuse to buy cattle from the said association; (3) by causing the dealers in the Kansas City market or any of them by any means or device whatsoever to refrain from buying or to refuse to buy cattle from the said association; and (4) by hindering, obstructing, or preventing any of said dealers from buying cattle from said association.

The court denied the plaintiffs' application for a temporary injunction with respect to the foregoing matters.

The court held that it is not proper for any one operator in the market to require another to participate in the same insurance policy and therefore sustained the order of the Secretary of Agriculture requiring the market agencies to cease and desist from refusing to trade with the Producers Commission Association by reason of the blanket insurance rule of the exchange, provided the association has its own insurance in full force equal in character, extent, persons, and risk to that provided by the blanket insurance policy covering members of the Kansas City Livestock Exchange.

The court held that the exchange would not be required to extend its blanket insurance to the association unless and until it becomes a member of the exchange or signs the market-practice agreement.

The court also held that all nonmembers of the Kansas City Livestock Exchange such as the Producers Commission Association should be accorded the use of the facilities of the clearing house or collection association by complying with the provisions of section 6 and paying the dues, taxes, and expenses provided by section 5 of article 15 of the by-laws of the exchange, provided that the exchange might require a reasonable bond, surety, or bank guaranty and that the Producers Commission Association is not under the necessity of becoming a member of the exchange or any marketing agreement. With these modifications the application for a temporary injunction was denied.

Notice was therefore given to all market agencies and dealers in the Kansas City market that upon proof of violation of the provision of the order of the

Secretary of Agriculture as sustained by the Federal court requiring market agencies and dealers in the Kansas City market to cease and desist from discriminating against the Producers Commission Association in respect to trading relations the necessary action to secure the imposition of criminal punishment as provided in the packers and stockyards act 1921 will be taken.

The Government filed an answer in the case and a final hearing will be held in due course.

Docket No. 40. In re Producers Cooperative Commission Association, Cleveland, Ohio, respondent:

On October 18, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had "weighed up" or "sold" livestock to itself without advising the consignors of the disposition made of their livestock. Respondent admitted the truth of the allegations, and on February 8, 1924, an order to cease and desist was issued.

Docket No. 41. In re Meeks, Boren & Thompson (Inc.), Cleveland, Ohio, respondent:

On October 23, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had "weighed up" or "sold" livestock to itself without advising the consignors thereof. Respondent admitted the truth of the allegations, and on February 8, 1924, an order to cease and desist was issued.

Docket No. 42. In re National Livestock Commission Co., Cleveland, Ohio, respondent:

On October 18, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had "weighed up" or "sold" livestock to itself without advising the consignors thereof. Respondent admitted the truth of the allegations, and on February 6, 1924, an order to cease and desist was issued.

Docket No. 43. In re The Greene Embury Co., Cleveland, Ohio, respondent:

On October 18, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that this respondent had overpaid certain shippers for their livestock. Respondent admitted the truth of the allegations, and an order to cease and desist was issued on February 8, 1924.

Docket No. 44. In re The Shippers Commission Co., Cleveland, Ohio, respondent:

On October 18, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had "weighed up" or "sold"

livestock to itself without advising the consignors thereof and that it had failed to advise consignors of the names of the purchasers of their livestock. Respondent admitted the truth of the allegations, and an order to cease and desist was issued on February 8, 1924.

Docket No. 45. In re A. E. Bower, trading and doing business as Bower & Bower, Cleveland, Ohio, respondent:

On January 31, 1924, the Secretary of Agriculture issued a complaint in which it was alleged that respondent had rendered incorrect account sales to shippers covering the sale of their livestock and had made overpayments to them. Respondent admitted the truth of the allegations, and an order to cease and desist was issued on April 23, 1924.

Docket No. 46. In re Benstead, Bryans & Co., a partnership composed of John Benstead, W. L. Bryans, and Plimy Miller, Cleveland, Ohio, respondents:

On October 23, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that the respondents had destroyed certain records pertaining to their business and that they had rendered incorrect account sales and had overpaid a shipper and had "weighed up" or "sold" livestock to themselves without advising the consignors thereof. Respondents admitted the truth of the allegations, and an order to cease and desist was issued on February 14, 1924.

Docket No. 47. In re J. E. Gibbons and J. C. Carnes, South St. Paul, Minn., respondents:

On November 3, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that the respondents had issued incorrect account sales and had failed to account to shippers for the entire proceeds received from the sale of their livestock. On May 5, 1924, the complaint was amended so as to make Harry E. Carnes a party thereto. Following a hearing, on June 14, 1924, respondents were ordered to cease and desist from rendering incorrect account sales.

Docket No. 48. In re Rogers & Amundson Commission Co. of South St. Paul, Minn., respondent:

On November 3, 1923, the Secretary of Agriculture issued a complaint alleging that the respondent had rendered incorrect account sales to shippers of livestock and had remitted more than the net proceeds derived from the sale of livestock. Respondent admitted the truth of the allega-



tions, and on March 20, 1924, an order to cease and desist was issued.

Docket No. 49. In re Drovers Livestock Commission Co. of South St. Paul, Minn., respondent:

On November 5, 1923, the Secretary issued a complaint alleging that the respondent had rendered incorrect account sales and had remitted less than the net proceeds of the several shipments referred to therein. Following a hearing, on May 26, 1924, an order to cease and desist from violating the act by rendering false account sales to consignors was issued.

Docket No. 50. In re McKissick, Alcorn & Magnus Co., South St. Paul, Minn., respondent:

On November 8, 1923, the Secretary of Agriculture issued a complaint alleging that incorrect account sales had been rendered shippers by the respondents and that they had remitted to shippers more than the net proceeds derived from the sale of livestock. On November 15, 1923, respondents admitted the allegations in said complaint, and on February 23, 1924, an order to cease and desist was issued.

Docket No. 51. In re Independent Commission Co., South St. Paul, Minn., respondent:

On November 22, 1923, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had weighed and sold together hogs belonging to different shippers and had made arbitrary estimates of weights and prices of the consignments of different shippers without authority. On December 4, 1923, respondent admitted the allegations of the complaint, and on February 23, 1924, an order to cease and desist was issued.

Docket No. 52. In re Farmers Union Livestock Commission, South St. Paul, Minn., respondent:

On January 6, 1924, the Secretary of Agriculture issued a complaint alleging that the respondent had remitted more than the net proceeds of the sale of livestock to certain shippers. Following a hearing on March 15, 1924, the Secretary of Agriculture issued an order dismissing the case.

Docket No. 53. In re Shannon & Farrell, a partnership composed of J. C. Farrell and Geo. A. Shannon, Pittsburgh, Pa., respondents:

On December 26, 1923, the Secretary of Agriculture issued a complaint alleging that the respondents had filed quarterly reports containing numerous incorrect entries; rendered incorrect

account sales showing a different number of head of livestock than the number actually received and sold; weighed up or sold livestock to themselves and incorrectly reported to shippers that it had been sold to other parties; reported to shippers that their livestock was sold to one party when it was sold to other parties; remitted more than the net proceeds of the sale of livestock in certain instances and in certain other instances less; and violated one of their rules relative to extending credit to purchasers, which rule was filed with the Packers and Stockyards Administration. Following a hearing on April 30, 1924, an order to cease and desist from the matters in question was issued.

Docket No. 54. In re John P. Bruemmer, trading and doing business as John P. Bruemmer & Sons; and A. W. Bruemmer and Lyman Bruemmer, Milwaukee, Wis., respondents:

The above case involves submitting false account sale to two shippers, reporting in each instance that one of the hogs was dead, while in fact the hog in each instance was alive, and also submitting incorrect account sales in three instances in that the price received for the livestock was reported at less than the actual price received. In said complaint it was alleged that A. W. and Lyman Bruemmer knew of and participated in said transactions. The case was heard before an examiner.

On June 12, 1924, the Secretary found that the evidence was not sufficient to show that Lyman Bruemmer participated in the transactions referred to in the complaint, but that John P. Bruemmer and A. W. Bruemmer had violated the act and issued an order requiring them to cease and desist.

Docket No. 55. In re Joyce Commission Co., a partnership, composed of T. F. Joyce and J. W. Joyce, South St. Paul, Minn., respondents:

On January 19, 1924, the Secretary of Agriculture issued a complaint alleging that the respondents had rendered incorrect account sales, had overpaid certain shippers, and had failed to advise a shipper that his livestock was sold to a buyer in whose business they had a pecuniary interest. Respondents admitted the truth of the allegations and on February 28, 1924, an order to cease and desist was issued.

Docket No. 56. The Newark Stockyards, Kearny, N. J., respondents:

This case involves an order of suspension of Supplement No. 2 to Sched-



rule No. 2 of respondent. Respondent sought to increase its rate on corn 10 cents a bushel and its rate on hay 25 cents per hundredweight. Respondent on December 4, 1923, notified the Secretary of its withdrawal of the proposed increases, and on December 6, 1923, the proceeding was discontinued.

Docket No. 57. In re Central Cooperative Commission Association, a corporation, South St. Paul, Minn., respondent:

On January 7, 1924, the Secretary issued a complaint alleging that respondent had rendered incorrect account sales to several shippers, referred to in the complaint. A hearing was held on February 14, 1924, the examiner has rendered a report in the case, and the respondent has filed exceptions thereto.

Docket No. 58. In re J. K. Newburn, formerly trading and doing business as McCall, Newburn & Joyce, Pittsburgh, Pa., respondent:

Under date of December 20, 1923, the Secretary filed a complaint alleging that respondent had rendered incorrect account sales and had given shippers checks in payment for their livestock which were not good when issued, although settlement was made with the shippers subsequently. It was also alleged that respondent had submitted incorrect quarterly reports and that certain livestock had been weighed up or sold to said market agency when the account sale to the shipper erroneously showed the purchaser to be some one else. J. K. Newburn admitted the allegations in the complaint, and on February 14, 1924, the Secretary issued an order directing him to cease and desist from the violations referred to in the complaint.

Docket No. 59. Holland & Maxwell Commission Co. v. St. Louis National Stockyards and Campbell & Reid and Western Sales Stables Co. of East St. Louis, Ill., respondents:

A complaint was filed by Holland & Maxwell Commission Co. against the two respondents referred to relating to the use of the horse and mule auction facilities of the stockyards. After the case was called for hearing the parties reached an agreement disposing of the controversy. On December 31, 1923, the Secretary issued an order, based on the agreement of the parties, and directed that the proceeding be discontinued without prejudice.

Docket No. 60. In re Bowles Livestock Commission Co., a corporation, Pittsburgh, Pa., respondent:

Under date of December 31, 1923, the Secretary of Agriculture issued a

complaint alleging that respondent had submitted numerous incorrect account sales showing erroneous weights and prices received for livestock. The respondent admitted the allegations with certain exceptions. The case was heard at Pittsburgh before an examiner, January 22, 1924. The Secretary issued a cease and desist order against the illegal practices referred to in the complaint.

Docket No. 61. The Jersey City Stock Yards Co., Jersey City, N. J., respondents:

On December 7, 1923, the Secretary issued an order of suspension of Schedule No. 3 of the respondent and set the case for hearing January 3, 1924, on the ground that the charges proposed were not justified at the time. On December 10, 1923, the respondent notified the Secretary in writing of the withdrawal of Schedule No. 3, which had been suspended, and the reinstatement of the rates and charges contained in its Schedule No. 2 and supplement thereto, whereupon the Secretary ordered that the proceeding be discontinued and the case dismissed.

Docket No. 62. In re Graves, Nave & Co., a partnership composed of Geo. W. Graves, Chris C. Nave, J. D. Oldham, D. R. Prather, and Max E. Graves, Indianapolis, Ind., respondents:

A complaint was issued December 21, 1923, alleging that the respondents rendered incorrect account sales in that the account sales show that respondents charged a greater compensation in some instances and a lesser compensation in other instances than the rates and charges specified in their published schedule. It was also alleged that the respondents incorrectly showed the names of purchasers to whom livestock was sold. Respondents admitted the truth of the allegations, and under date of February 8, 1924, the Secretary issued an order directing the respondents to cease and desist from the illegal practices referred to in the complaint.

Docket No. 63. In re Rice Bros., a corporation, Sioux City, Iowa., respondent:

The Secretary of Agriculture issued a complaint under date of December 3, 1923, alleging that the respondent rendered an incorrect account sale in that a shipment of livestock was shown to be sold to one party when in fact it was sold to another party. The respondent submitted a satisfactory explanation of the apparent violation referred to in the complaint, and under date of January 31, 1924, the Secretary dismissed the complaint.

Docket No. 64. In re D. C. Kitselman, trading and doing business as the Kitselman Commission Co., Sioux City, Iowa, respondent:

In a complaint issued December 31, 1923, by the Secretary of Agriculture, it is alleged that respondent rendered incorrect account sales in that it marked up and down livestock belonging to several shippers without authority to do so and by so doing in several instances the respondent charged more than the rates and charges specified in the schedules filed and in effect at the time. On January 15, 1924, the respondent admitted the allegations and waived an oral hearing, and on April 11, 1924, the Secretary issued an order to the respondent to cease and desist from the illegal practices above referred to.

Docket No. 65. In re Cliff Warrick, trading as the Sioux City Livestock Commission Co., Sioux City, Iowa, respondent:

Under date of December 31, 1923, the Secretary issued a complaint alleging that in two instances referred to in detail in the complaint the respondent had rendered incorrect account sales by showing that the livestock sold at a higher price than it did actually sell for. On January 22, 1924, the respondent admitted the allegations in the complaint, and the Secretary on February 8, 1924, issued an order to the respondent to cease and desist from such violations of the act.

Docket No. 66. In re Wood Bros. & Co., a corporation, Sioux City, Iowa, respondent:

The complaint in this case consisted of three paragraphs and was issued by the Secretary January 4, 1924. It was alleged that the respondent incorrectly reported to the shippers the names of the true purchasers of livestock. The respondent submitted in writing an explanation of the apparent violations, and on January 24, 1924, the Secretary ordered that the proceeding be discontinued.

Docket No. 67. In re Louis Lyons and C. L. Lyons, trading and doing business under the firm name of Louis Lyons & Son, Lancaster, Pa., respondent:

The Secretary of Agriculture issued a complaint dated January 9, 1924, alleging that the respondent rendered an incorrect account sale in that a shipment of livestock was reported as being sold at 10 cents per 100 pounds less than it was actually sold for. The respondent admitted the allegations, and on January 30, 1924, the Secretary issued a cease and desist order.

Docket No. 68. In re Joe S. Taylor & Co., a partnership composed of J. S. Taylor, Wm. M. Owens, W. D. Mattern, and W. C. Voris, Indianapolis, Ind., respondents:

Under date of January 9, 1924, the Secretary issued a complaint alleging that the respondents rendered two incorrect account sales, each showing that the livestock involved was sold at a higher price than that at which it did actually sell. Respondents admitted the allegations in the complaint, and on January 30, 1924, the Secretary issued an order to the respondents to cease and desist from such violations.

Docket No. 69. In re Seth M. Lorah, Lancaster, Pa., respondent:

On January 9, 1924, the Secretary of Agriculture issued a complaint alleging that the respondent had sold shipments of livestock at a higher price than that actually reported in the account sales to the shippers. Under date of January 21, 1924, the respondent admitted the allegations in the complaint and waived an oral hearing, and on January 30, 1924, the Secretary of Agriculture issued an order to the respondent to cease and desist from such violations.

Docket No. 70. In re A. O. Bennett, trading and doing business as the Bennett Commission Co., Indianapolis, Ind., respondents:

Under date of January 11, 1924, the Acting Secretary of Agriculture issued a complaint alleging in three instances that the respondent had remitted more than the actual net proceeds of the livestock referred to in detail in the complaint. On January 17, 1924, the respondent admitted the allegations in the complaint, and on January 30, 1924, the Secretary issued an order directing the respondent to cease and desist from such violations.

Docket No. 71. In re Abe Burnett & Co., a corporation, Chicago, Ill., respondent:

Under date of January 1, 1924, the Acting Secretary of Agriculture issued a complaint alleging that, after promptly accounting for livestock and charging the rates set forth in the schedule on file and in effect, the respondent subsequently remitted an additional sum of \$21.19 to be distributed among three shippers. On January 16, 1924, the respondent admitted the allegations in the complaint, and the Secretary, on April 9, 1924, issued an order directing respondent to cease and desist from continuing such violations.



Docket No. 72. In re Coburn, Schwab & McMaster, a partnership composed of M. E. Coburn, H. G. Schwab, and Alex McMaster, Indianapolis, Ind., respondents:

Under date of January 11, 1924, the Acting Secretary of Agriculture issued a complaint alleging that respondents had rendered incorrect account sales in that the weight of the livestock was erroneously given in certain instances and the price at which said livestock was sold was erroneously given in other instances. On January 19, 1924, respondents admitted the allegations set forth in the complaint, and on January 30, 1924, the respondents were ordered by the Secretary of Agriculture to cease and desist from such violations in the future.

Docket No. 74. In re Gish, Carmichael & Co., a partnership composed of D. J. Gish, Otis Carmichael, Parks Harrison, Arthur Surber, Carl C. Barnett, and Wm. F. Long, Indianapolis, Ind., respondents:

Under date of January 11, 1924, the Acting Secretary issued a complaint alleging that in the six shipments referred to in the complaint the respondents rendered incorrect account sales in that the livestock was reported as having been sold at a higher price than it was actually sold at. Under date of January 19, 1924, the respondent acknowledged in writing the allegations in the complaint and waived an oral hearing, and on January 30, 1924, the Secretary of Agriculture issued an order directing the respondents to cease and desist from such violations.

Docket No. 75. In re Gillespie, Clark & Beck, a partnership composed of B. W. Gillespie, C. H. Clark, M. W. Beck, and Frank Whiting, Indianapolis, Ind., respondents:

Under date of January 11, 1924, the Acting Secretary issued a complaint in which it was alleged that respondents remitted to the shippers a greater amount than the actual net proceeds in one case and a less amount than the actual net proceeds in the other case. In the latter case, however, the respondent subsequently remitted the difference to the shipper. Under date of January 17 the respondent acknowledged in writing the allegations in the complaint and waived an oral hearing. On February 19, 1924, the Secretary issued a cease and desist order against the respondents to cease and desist from such violations.

Docket No. 76. In re Farmers Educational & Cooperative State Union of Nebraska, the Farmers Union Livestock Commission, and C. H. Withey, South Omaha, Nebr., respondents:

On January 11, 1924, the Acting Secretary of Agriculture issued a complaint consisting of five numbered paragraphs in which it was alleged that the respondents after correctly accounting to shippers made additional remittances to them. Respondents on May 21, 1924, admitted the truth of the allegations, and an order will be issued in the case in due course.

Docket No. 77. In re Peoples Cooperative Sales Agency (Inc.), South St. Paul, Minn., respondent:

On January 16, 1924, the Acting Secretary of Agriculture issued a complaint alleging that in numerous instances respondent had remitted a portion of its rates and charges to shippers in violation of the act. Following a hearing, the Secretary issued an order directing the respondent to cease and desist from refunding any portion of the rates or charges specified in its published tariff except by bona fide returning to its members on a patronage basis its excess earnings on their livestock.

Docket No. 78. In re Hugh Middlesworth, trading and doing business as the Middlesworth Commission Co., Indianapolis, Ind., respondent:

Under date of January 25, 1924, the Secretary of Agriculture issued a complaint alleging that the respondent had rendered incorrect account sales to shippers in that in six instances a greater amount than the net proceeds had been remitted to shippers and in one instance a lesser amount had been remitted than the net proceeds. The respondent filed a statement admitting the allegations in the complaint and waiving an oral hearing, and the department will take appropriate action in the near future.

Docket No. 79. In re Sioux City Livestock Commission Co. and other market agencies operating at the Sioux City Stockyards, Sioux City, Iowa:

The Sioux City Livestock Commission Co., Kitselman Commission Co., and Wood Bros. & Co., market agencies, duly registered as such at the Sioux City Stockyards, filed complaints for certain shippers and requested authority to make reparation to such shippers on account of having made excess collections due to inequities in their tariffs as published. Under date of February 6, 1924, the above-named market agencies were authorized to make reparation.



Docket No. 80. In re Southern Stockyards Corporation, trading and doing business under the name of Smyth Bros.-McCleary-McClellan, Richmond, Va., respondent:

Under date of February 20, 1924, the Secretary issued a complaint alleging that numerous shippers referred to in the complaint had been charged less than the published tariff charges for the sale of livestock, also that the respondent had charged a commission on the sale of the less-than-carload shipments of horses and mules without having filed any tariff covering such charges. The case was heard before an examiner and a tentative report rendered to which no exceptions have been filed. The case is now pending.

Docket No. 81. Minnesota Pig & Cattle Co., complainant, v. Central Cooperative Commission Association, South St. Paul, a corporation, defendant:

On February 19, 1924, the complainant filed a complaint against the defendant alleging that the defendant had refused to sell pigs to the complainant without reasonable cause in violation of Title III of the packers and stockyards act. Subsequently the defendant filed a motion looking to the dismissal of the complaint, which was denied on March 31, 1924, and the case set for hearing.

Docket No. 82. Spokane Union Stockyards Co., Spokane, Wash., respondent:

On March 4, 1924, the Secretary of Agriculture suspended Supplement No. 3 to the Tariff No. 1 of the respondent, which proposed to increase the rate or charge for yardage on livestock and assigned the case for hearing. The case was duly heard by an examiner and on July 12, 1924, the Secretary of Agriculture dismissed the proceedings without prejudice as the proposed increases appeared to be justified.

Docket No. 83. In re Barefoot Livestock Commission Co., and other market agencies at Oklahoma City, Okla., respondent:

The Secretary, under date of February 29, 1924, issued an order of inquiry into the reasonableness of rates and charges of numerous market agencies set out in the order of inquiry and assigned the case for hearing. The hearing was held April 8, 9, and 10, 1924, at which time testimony was taken and exhibits were introduced showing audits of the business of the various commission concerns operating on this market. The tentative findings of the examiner are being prepared.

Docket No. 84. In re Belt Railroad & Stockyards Co., Indianapolis, Ind., respondent:

On March 10, 1924, the Secretary issued an order of inquiry into the lawfulness of respondent's Supplement No. 1 to Tariff No. 3 involving the reasonableness of charges made for vaccinating services furnished by the respondent. Following a hearing, an order was issued on May 26, 1924, reducing the rates for vaccinating services, and these rates have been put into effect.

Docket No. 85. In re John Clay & Co., a partnership composed of John Clay, J. G. Forrest, F. H. Connor, and C. A. Klemm, Chicago, Ill.:

On March 20, 1924, the Secretary issued a complaint alleging that the respondent rendered incorrect accounts sales in that a fictitious name was given in lieu of the true name of the purchaser in several instances referred to in detail in the complaint and that the respondents had violated their rule 27, section 1, which rule pursuant to the packers and stockyards act was duly filed with the Packers and Stockyards Administration and prohibited the respondents from weighing up or selling livestock to themselves. The case has been set for hearing.

Docket No. 86. In re Frank P. Clark, trading and doing business as Holmes & Clark, Philadelphia, Pa., respondent:

On March 20, 1924, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had sold livestock to a concern in which it had a pecuniary interest without disclosing such fact to the shipper. Respondent admitted the truth of the allegations, and on May 24, 1924, an order to cease and desist was issued.

Docket No. 87. Nashville Union Stockyards (Inc.), Nashville, Tenn., respondent:

On March 31, 1924, the Secretary of Agriculture issued an order of inquiry for the purpose of investigating the reasonableness of respondent's charge for corn. Later the order of inquiry was amended so as to include the reasonableness of all rates and charges of the respondent. The case was heard by an examiner on June 16, 17, 18, 1924.

Docket No. 88. In re Farmers Educational and Cooperative State Union of Nebraska, South St. Joseph, Mo., trading and doing business as the Farmers Union Livestock Commission, respondent:

On March 31, 1924, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had received and sold plural ownership consignments of livestock and

had rendered individual account sales to the persons interested in them which incorrectly stated the weight of the livestock, the price per 100 pounds received therefor, and the expense incident to its sale, and that respondent had failed to report to shippers in certain instances the correct number of livestock sold and had failed to advise a shipper that his sheep had been sold to one of respondent's salesmen. It was also alleged that respondent had refunded or remitted a portion of its rates and charges to shippers who were not its members. On May 21, 1924, respondent admitted the truth of the allegations.

Docket No. 89. In re H. G. Whaley, trading and doing business as Rice & Whaley Co., Buffalo, N. Y., respondent:

On March 31, 1924, the Secretary of Agriculture issued a complaint alleging that the respondent had rendered incorrect account sales to shippers. It was also alleged that the respondent did not keep copies of certain account sales rendered to shippers. On April 4, 1924, the respondent submitted an answer making a general denial of the allegations contained in the complaint. The case will be set for hearing.

Docket No. 90. In re Producers Cooperative Commission Association (Inc.), Buffalo, N. Y., respondent:

On March 31, 1924, the Secretary of Agriculture issued a complaint alleging that respondent had rendered incorrect account sales in that livestock had been reported as sold to a fictitious person, such fictitious person being used by the respondent to designate its "weigh-up" account, and had also rendered an incorrect account sale in that the livestock was reported as sold at a higher price than it was actually sold. On March 7, 1924, the respondent admitted the allegations in the complaint and waived an oral hearing. The Secretary issued an order dated July 12, 1924, to the respondent to cease and desist from such practices.

Docket No. 91. In re Stacy, Bement & Beadle (Inc.), of Buffalo, N. Y., respondent:

On March 31, 1924, the Secretary of Agriculture issued a complaint alleging that the respondent rendered incorrect account sales showing that livestock was sold at a higher price than it was actually sold for, and also showing that the livestock was weighed up or sold to said market agency itself when in fact it was sold to some other party. The respondent declined to admit the

truth of the allegations and the case will be set for hearing.

Docket No. 92. South St. Joseph Livestock Exchange, of South St. Joseph, Mo., v. the Farmers' Union Livestock Commission Co., South St. Joseph, Mo., respondent:

The complainant, on February 23, 1924, filed a complaint alleging that respondent was not a cooperative association of producers and hence was not entitled to operate as such. The hearing was held from May 23 to May 28, and the examiner's report is receiving attention.

Docket No. 93. In re C. F. Noble, trading and doing business as Coulbourn & Noble, Philadelphia, Pa., respondent:

On April 3, 1924, the Secretary issued a complaint in which it was alleged that the respondent had rendered incorrect account sales and had overpaid certain shippers and had underpaid other shippers. It was also alleged that he had sold hogs to a corporation in which he held stock without disclosing to the owners of the hogs that he had a pecuniary interest in the corporation. On April 7, 1924, an answer was filed by the respondent, admitting the allegations and waiving an oral hearing.

Docket No. 94. In re C. J. Rice, Philadelphia, Pa., respondent:

On April 3, 1924, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had rendered incorrect account sales and had failed to account to shippers for the entire proceeds received from the sale of their livestock. It was also alleged that the respondent failed to furnish correct reports to the Secretary of Agriculture with respect to his financial condition as required by law. Respondent admitted the allegations contained in the complaint, and an order to cease and desist was issued on April 8, 1924.

Docket No. 95. In re Farmers' Educational and Cooperative State Union of Nebraska, trading and doing business as the Farmers' Union Livestock Commission, South Omaha, Nebr., respondent:

On April 8, 1924, the Secretary of Agriculture issued a complaint in which it was alleged that this respondent while operating as a cooperative agency had refunded a portion of its commission charges to shippers of livestock who were nonmembers thereof. On May 21, 1924, respondent admitted the truth of the allegations.

Docket No. 96. In re Farmers' Educational & Cooperative State Union of Nebraska, trading and doing business as the Farmers' Union Livestock Commission of Sioux City, Iowa, respondent:

On April 15, 1924, the Secretary of Agriculture filed a complaint alleging



that while operating as a cooperative agency the respondent had remitted a portion of its commission charges for selling livestock to shippers thereto who were not members thereof. Respondent on May 21, 1924, admitted the truth of the allegations.

Docket No. 97. *Roberts & Oake, complainant, v. The Union Stockyard & Transit Co., Chicago, Ill., defendant:*

On April 12, 1924, complainant filed a complaint against the defendant claiming reparation in the sum of \$35.10, based on the alleged fact that the defendant had delivered hogs belonging to complainant to another packer. The complainant also prayed that a cease and desist order be issued by the Secretary against the defendant from continuing the alleged unreasonable and discriminatory practice of delivering complainant's hogs to others. The case was duly heard by an examiner, who sustained the allegations. Exceptions were filed by the defendant. The case has been assigned for argument before the Secretary for July 21, 1924.

Docket No. 98. *In re Donahue Bros. (Inc.), South Omaha, Nebr., defendant:*

On April 23, 1924, the Secretary issued a complaint consisting of 36 numbered paragraphs. This complaint dealt with numerous alleged violations of the act, among which were that the respondent disposed of funds in its possession or control so as to impair the prompt accounting to shippers of livestock; rendered incorrect account sales giving erroneous names of the purchasers; and credited money to respondent's estray account which should have been transmitted to the shipper of the livestock. The respondent declined to admit the truth of the allegations in the complaint and the case has been assigned for hearing July 24, 1924.

Docket No. 99. *In re Ransom, Mansfield & Co., a partnership composed of K. G. Mansfield and C. C. Mansfield, Buffalo, N. Y., respondent:*

The Secretary issued a complaint in this case under date of April 23, 1924, alleging that the respondent rendered incorrect account sales in that the true name of the purchaser was not shown and that certain livestock was actually sold at a greater price than was reported in the account sale, and in certain instances the initials of the purchaser only were shown. The case is pending.

Docket No. 100. *In re Swope, Hughes, Waltz & Benstead Commission Co., a corporation, Buffalo, N. Y., respondent:*

On April 23, 1924, the Secretary issued a complaint alleging that the respondent rendered incorrect account sales showing that certain livestock was weighed up to itself at one price, when in fact it was sold to another party at a different price. In a letter dated May 3, 1924, the respondent filed an answer to the charges contained in the complaint and the case is now pending.

Docket No. 101. *Minnesota Pig & Cattle Co. v. Central Cooperative Commission Association, South St. Paul, Minn., respondent:*

On April 14, 1924, the Minnesota Pig & Cattle Co. filed a complaint alleging that the respondent has been engaging in and using unfair practices in connection with the receiving, marketing, buying, and selling on a commission basis, feeding, weighing, and handling of livestock in commerce at the South St. Paul stockyards. On April 15, 1924, this complaint was forwarded to the respondent in order that it might be satisfactorily explained or an answer made within 10 days from the receipt thereof. The time allowed for filing an answer was extended to May 20, 1924. On May 17, 1924, the respondent made certain motions upon consideration of which the Secretary on May 29, 1924, ordered that so much of said complaint as constituted a repetition of the charges in the complaint in docket No. 81 be dismissed and that the complainant be allowed 10 days from the receipt of notice thereof to amend the complaint in certain particulars. On June 12, 1924, the complainant filed an amendment to the complaint, which on June 16, 1924, was transmitted to the respondent so that it might satisfy or answer the same.

Docket No. 102. *In re The Hubbard, Hauss & Raggsdale Co., Cincinnati, Ohio, respondent:*

On April 25, 1924, the Secretary issued a complaint alleging that respondent rendered incorrect account sales resulting in underpayments to shippers in four instances and an overpayment in one instance and that the respondent destroyed certain records without the consent in writing of the officer in charge of the Packers and Stockyards Administration at Washington, D. C. The respondent admitted the charges in the complaint, and under date of May 29 an order was issued to cease and desist.



Docket No. 103. In re Heilbron & Loeb, a partnership composed of Michael Loeb and Samuel L. Heilbron, Philadelphia, Pa., respondent:

On April 25, 1924, the Secretary of Agriculture issued a complaint in which it was alleged that the respondents had "weighed up" or "sold" livestock to themselves without advising the consignors of that fact. It was also alleged that the respondents had filed incorrect financial reports with the Secretary of Agriculture.

Docket No. 104. In re St. Joseph Livestock Commission Co., a partnership composed of D. B. Cogill, Louis Combs, and A. H. Thurman; and Thomas Calhoun and George Vonderhite, their employees, South St. Joseph, Mo., respondents:

On April 30, 1924, the Secretary of Agriculture issued a complaint in which it was alleged that the respondents had entered into an agreement with a certain trader under which they were to receive a portion of the profits derived from reselling hogs previously sold to him by them and that said agreement was unknown to their shippers. It was also alleged that they failed to advise shippers of their pecuniary interest in the business of the trader to whom they sold hogs. It was further alleged that respondents had "weighed up" or "sold" hogs to themselves for the purpose of speculating in them without disclosing the facts to the shippers. Respondents admitted the truth of the charges.

Docket No. 105. In re William G. Gross, trading and doing business as Christian Gross & Bros., Philadelphia, Pa., respondent:

On May 2, 1924, the Secretary of Agriculture issued a complaint in which it was alleged that the respondent had "weighed up" or sold hogs to himself without disclosing this fact to the consignors. Said respondent having ceased to operate as a market agency, the complaint was dismissed without prejudice.

Docket No. 106. In re Fort Worth Stock Yards Co., Fort Worth, Tex., respondent:

On May 5, 1924, the Secretary of Agriculture issued an order of inquiry and notice of hearing in the above case, involving the lawfulness of a regulation of the respondent which provided that all persons doing business in its yards should execute bonds to the respondent for not less than \$5,000 each. The case was assigned for hearing and was heard on June 5, 1924. The examiner issued a tentative report advising the interested parties that exceptions could be filed thereto.

Docket No. 107. In re Williamson and Dennis, Jacksonville, Fla., respondent:

The Secretary of Agriculture on May 6, 1924, issued a complaint alleging that the respondent rendered incorrect account sales, that the correct name of the purchaser was not given, and that the correct commission was not charged, in numerous instances. Respondent submitted an answer to the charges.

Docket No. 108. In re Equity Cooperative Livestock Sales Association (Inc.), Milwaukee, Wis., respondent:

On May 24, 1924, the Secretary issued a complaint alleging that the respondent after rendering correct account sales to the shippers, remitted additional amounts to the shippers in violation of the act. On June 3, 1924, the respondent admitted the truth of the allegations and waived an oral hearing. Under date of June 14, the Secretary issued an order to cease and desist.

Docket No. 109. In re Delmue Livestock Commission Co., North Salt Lake, Utah, respondent:

On May 24, 1924, the Secretary issued a complaint alleging that the respondent rendered an incorrect account sale charging a commission of \$18, notwithstanding the charges specified in his schedule filed and in effect at the time were only \$14.70.

Docket No. 110. In re National Livestock Commission Co., Chicago, Ill., respondent:

On May 24, 1924, the Secretary issued a complaint alleging that incorrect account sales were rendered shippers showing erroneous names of purchasers as set forth in detail in the complaint.

Docket No. 111. In re Hunsaker Livestock Commission Co., a corporation, Ogden, Utah, respondent:

On May 24, 1924, the Secretary of Agriculture issued a complaint alleging that the respondent rendered incorrect account sales in which a different commission was charged from that specified in the schedules filed and in effect at the time and the respondent rendered account sales showing initials only of purchasers in many instances. In certain instances the account sales were incorrect in that they showed that the livestock was sold at a different price from which they were actually sold. The case is under investigation.

Docket No. 112. In re Fisher Livestock Commission Co., a corporation, North Salt Lake, Utah, respondent:

On May 24, 1924, the Secretary issued a complaint alleging that the re-

spondent in two instances charged a larger commission for selling livestock than the charges specified in the schedules filed and in effect at the time. The case is under investigation.

Docket No. 113. In re H. T. Gant, trading as the Gant Livestock Commission Co., South Omaha, Nebr., respondent:

On May 24, 1924, the Secretary issued a complaint alleging that the respondent had rendered incorrect account sales showing that certain livestock in one instance was sold at a higher price than it was actually sold, and in another instance, that the respondent sold livestock contingent upon the price that other livestock was sold in violation of its rule, which was, pursuant to the packers and stockyards act, filed with the department. An explanation was submitted by the respondent in regard to the first charge, and after investigation was found to be correct. The case is pending as to the other charge.

Docket No. 114. In re E. J. Netherton, St. Joseph, Mo., complainant, v. St. Joseph Stockyards Co., South St. Joseph, Mo., defendant:

On May 19, 1924, the complainant filed a complaint alleging violation of the act in that the defendant had demanded and collected rates and charges which were unjust, unreasonable, and discriminatory for services furnished at the stockyards owned by it, and that the defendant had established, observed, and enforced unjust, unreasonable, and discriminatory regulations and practices in respect to furnishing stockyards services to complainant. A copy of the complaint was served on the defendant, who denied the charges. Later the complainant withdrew the complaint.

Docket No. 115. In re B. R. Wilkerson, Denver, Colo., respondent:

The Secretary issued a complaint alleging that respondent had been operating as a market agency without having registered as such.









SEP 15 1924

## REPORT OF THE CHIEF OF THE BUREAU OF PLANT INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF PLANT INDUSTRY,  
*Washington, D. C., September 4, 1924.*

SIR: I have the honor to submit herewith a report of the work of the Bureau of Plant Industry for the fiscal year ended June 30, 1924.

Respectfully,

WM. A. TAYLOR,  
*Chief of Bureau.*

HON. HENRY C. WALLACE,  
*Secretary of Agriculture.*

### WORK AND ORGANIZATION

The activities of the Bureau of Plant Industry are primarily devoted to agricultural research and related experiments, although incidental service and regulatory functions and extension work are also under way. The scope of the research work includes the study of destructive plant diseases and the establishment of methods of eradication and control; the improvement of crop, ornamental, or other economic plants by breeding and selection; the introduction of promising seeds and plants from foreign countries; the improvement of methods of plant production; and the utilization of plants of economic value.

The service activities are in cooperation with authorities of the States concerned. During the past year these included a campaign for the eradication of the barberry in 13 important wheat-growing States for the purpose of controlling black stem rust of wheat; the eradication of currants in the New England, Great Lakes, and Pacific Northwest areas to control the blister rust of white pine; and the eradication of citrus canker from the Gulf States.

The regulatory activities during the year have been limited to the enforcement of the seed-importation act and the extension activities to the administration of the demonstration work upon Federal reclamation projects.

For purposes of economic administration the work is divided into 77 group projects, comprising in all 325 subsidiary projects.

The appropriations available for the work of the bureau for the past fiscal year were approximately \$3,485,000. This was apportioned as authorized by law to the several types of work under way, as follows:

Research work	\$2,700,000
Service work	735,000
Extension work	40,000
Regulatory work	10,000
Total	3,485,000

This report outlines the work of the bureau not otherwise recorded, summarizing the status of the most significant accomplishments during the past fiscal year.

A list of the publications issued during the year is appended, reporting in detail the various lines of research under way.

The work of the bureau has been carried on by the following organization:

Office of the chief-----	William A. Taylor, physiologist and pathologist and chief of bureau. K. F. Kellerman, physiologist and associate chief of bureau. H. E. Allanson, assistant to the chief of bureau.
Laboratory of plant pathology-----	Erwin F. Smith, pathologist in charge.
Plant-disease survey and pathological collections.	C. L. Shear, pathologist in charge.
Fruit-disease investigations-----	M. B. Waite, pathologist in charge.
Citrus-canker eradication-----	Directed by the associate chief of bureau.
Forest-pathology investigations-----	Haven Metcalf, pathologist in charge.
Blister-rust control-----	S. B. Detweiler, pathologist in charge.
Cotton, truck, and forage crop disease investigations.	W. A. Orton, pathologist in charge.
Crop physiology and breeding investigations.	W. T. Swingle, physiologist in charge.
Soil-bacteriology investigations-----	F. Löhnis, bacteriologist in charge.
Soil-fertility investigations-----	Oswald Schreiner, biochemist in charge.
Crop acclimatization and adaptation investigations.	O. F. Cook, biomonomist in charge.
Fiber-plant investigations-----	L. H. Dewey, botanist in charge.
Drug, poisonous, and oil plant investigations.	W. W. Stockberger, physiologist in charge.
Plant physiological investigations-----	H. L. Shantz, physiologist in charge.
Agricultural technology-----	N. A. Cobb, technologist in charge.
Seed-testing laboratories; enforcement of seed-importation act.	E. Brown, botanist in charge.
Cereal investigations-----	C. R. Ball, cerealist in charge.
Tobacco and plant-nutrition investigations.	W. W. Garner, physiologist in charge.
Alkali and drought resistant plant investigations.	T. H. Kearney, physiologist in charge.
Sugar-plant investigations-----	E. W. Brandes, pathologist in charge.
Economic and systematic botany-----	Frederick V. Coville, botanist in charge.
Dry-land agriculture-----	E. C. Chilcott, agriculturist in charge.
Western irrigation agriculture-----	C. S. Scofield, agriculturist in charge.
Horticultural investigations-----	L. C. Corbett, horticulturist in charge.
Gardens and grounds-----	J. W. Byrnes, assistant in charge.
Demonstrations on reclamation projects-----	A. C. Cooley, agriculturist in charge.
Arlington Experiment Farm-----	E. C. Butterfield, assistant horticulturist in charge.
Foreign seed and plant introduction-----	David Fairchild, agricultural explorer in charge.
Forage-crop investigations-----	C. V. Piper, agrostologist in charge.
Biophysical investigations-----	G. N. Collins, botanist in charge.

## FIELD ACTIVITIES

Those who are familiar with the activities of the bureau as they are to-day and those of the department as they were 30 or more years ago know that the first steps looking toward a broader extension of the department's work were those having for their object the practical application in the field of studies made in the laboratory. Field activities, including the establishment of a few modest field stations, began with the study and treatment of plant diseases and related subjects. The value of this work became so immediately evident that it was rapidly expanded to include numerous other lines of investigation. Gradually there was evolved the field-station plan, including co-operative field activities, the latter leading eventually to farm demonstration work in the South, and later in the North and West, the Lever Extension Act, and the Farm Bureau system as it exists to-day. Field stations and field studies, therefore, have come to be recognized as fundamental necessities in the advancement

of agriculture in this country. Practically every major project of the bureau has its ramifications in field activities. In fact, it is safe to say that fully 60 per cent of all the investigative work is in the field as distinguished from that carried on in the laboratories in Washington.

The field activities and field stations of the bureau, as distinguished from the laboratory and administrative and directive work conducted in Washington, may be grouped under three general heads: (1) That work carried on in various parts of the country on land owned by the Government and used and controlled by the bureau, (2) that conducted on land rented by the bureau, and (3) that carried on where land and other facilities are provided as part of a joint co-operative plan. The last is conducted for the most part in cooperation with the State experiment stations.

Under the first group, where work is being conducted on land owned by the Government and used and controlled by the bureau, activities are under way in 16 States. This work



involves the use of 5,019 acres of land. The original cost of this land to the Government was nominal, amounting, all told, to \$85,375. Much of it was acquired without cost. The improvements made by the department, including buildings and other equipment on this land, have an estimated value of \$517,626. The estimated value of all the property, including land and buildings, is \$2,362,716.

Under the second group, where land is rented by the bureau, work is carried on in 20 States. The use of 3,045 acres is involved in this work, and the total annual rental is \$5,959. In practically all of these 20 States where work of this character is conducted, facilities in the shape of buildings, including laboratories, cottages for the employees, barns, etc., are included in the equipment for which rental as above stated is paid.

The work of the third group of activities, where land and facilities are used cooperatively by the bureau, is conducted in 33 States. No expenses for rentals are involved in these cooperative activities. In numerous cases large tracts of land are furnished by the State experiment stations and other cooperative agencies. Laboratories, greenhouses, and other facilities are also provided without expense to the department.

It is the policy of the bureau to regard the field station as a place outside of Washington where research and experimentation may be carried on, furnishing conditions, materials, and surroundings that will insure practical results applicable to the regions involved. The field station, in short, is a place where fundamental problems are attacked and solved, but above all where the acid test is applied to the theories and ideas developed within the four walls of the laboratory.

## FRUITS

### CITRUS

**New hybrids.**—The breeding work with citrus varieties and stocks has made definite progress during the past year. The Eustis limequat, a hybrid between the lime and the kumquat, has received substantial recognition as an addition to the list of commercial citrus fruits, being in effect a hardy lime. It has proved a satisfactory substitute for the lime or lemon, very much hardier than either and more resistant to the common citrus diseases. Its immunity to lime wither-tip is of especial importance, since this

specific disease threatens to curtail seriously the production of West Indian limes in the near future.

Two other hybrids, the Rusk citrange and the Thomasville citrangequat, have recently attracted favorable attention, not only for use as hardy "ade" fruits but especially as hardy and disease-resistant stocks for the Satsuma orange. It has been demonstrated that the Satsuma fruit quality and season of maturity on the Rusk citrange stock are equal to those on the trifoliate stock, but further tests on production are necessary. Buds on this stock are fully as hardy as on the trifoliate-orange stock. Furthermore, the Rusk stock is adapted to a number of situations in Texas and the Southwest where the trifoliate orange is a total failure.

The rapid introduction of both of these promising hybrid stocks has been somewhat hindered by the few-seeded character of their fruits. This difficulty has been met by the development of a rapid and cheap method of rooting fine twig cuttings which are produced in large numbers by these hybrids. A propagation frame using sunlight as a source of bottom heat has been perfected, which gives excellent results. This method for the propagation of such cuttings has wide application in horticulture and is already being adopted by commercial nurseries not only for citrus but for many other plants. So efficient is this new type of equipment and the technique involved that cuttings of such plants as the avocado and lychee, usually rated as extremely difficult to root, are handled successfully.

One of the results of the citrus-breeding work inaugurated many years ago which has only recently come to light is the production of a seedless variety of grapefruit. The variety, propagated in Florida in recent years as the "Davis Seedless," is derived from a "false" hybrid originated by this bureau. It is a seedling grapefruit, grown from seed of a grapefruit pollinated with tangerine pollen. This variety is earlier and larger than the standard Marsh Seedless, but has not been widely tested outside of Dade County, Fla., where the original tree is still growing.

**Wild relatives for stocks.**—During the past year progress has been made in the utilization of wild relatives of citrus for stocks. In particular, a hybrid of two wild Australian species of *Microcitrus*, which has made phenomenal growth in California, has been introduced in sufficient numbers for

experimental trials on different soils. It is a hybrid between the finger lime of Australia (*Microcitrus australasica*) and the round lime (*Microcitrus australia*). It makes extraordinary growth and is able to thrive on soil low in humus and other organic matter. After many futile efforts, it was found possible to propagate this species readily from softwood cuttings.

Another Australian stock of interest is the desert lime or desert kumquat (*Eremocitrus glauca*), which is a gray-green desert shrub unlike any other citrus relative. It grows in Australia under desert conditions and is able to withstand long droughts without injury. It grows in soil almost entirely devoid of humus or other organic matter. Heretofore this species resisted all efforts at propagation, and seeds could be obtained from Australia in only very small quantities, but during the past year it has fruited abundantly at the United States date garden, Indio, Calif., and more than a thousand young seedlings are now being grown.

**Bud selection.**—The outstanding developments of the bud-selection studies have come with the fruiting in considerable numbers of the progeny trees which were propagated earlier in the course of the work from trees of known performance. The progeny trees propagated from selected parent trees representing different bud variations have reached an age at which they are beginning to substantiate the earlier conclusions with respect to the ability of a parent tree to perpetuate its characteristics or for an individual limb showing a mutation to perpetuate its characteristics.

With remarkable consistency the records extending now over several crops produced by many of the progeny trees show that the peculiarities of the parent tree or the parent branch where the bud was taken from such source are perpetuated in progeny trees. It is apparent from these studies that the season of production as well as the quantity and quality of crop can be influenced through propagating early-ripening and desirable fruiting variations. The possibility of top-working healthy trees and those of undesirable strains in established orchards in order to improve the quantity and quality of the crop produced in those orchards is a matter of great importance to a large number of citrus orchardists in the Southwest.

The making of citrus-tree performance records in the commercial groves in California and Arizona is being ex-

tended year by year. The purpose of these records is to locate drone or otherwise undesirable trees for top-working, to find superior parent trees that are desirable as sources of budwood for propagation, and to measure the results of certain cultural practices, such as pruning, irrigation, and fertilization. In the course of the work a superior strain of the Marsh grapefruit was located in 1915. This strain has been propagated commercially. Records of this strain kept for several seasons have brought to light individual trees which are outstanding in their yield and in the quality of their fruit. These trees have been selected as sources of budwood for further propagation. Practically all of the propagation of grapefruit in California is now being done with buds from these selected trees.

In Alabama the work consists chiefly in assisting growers and nurserymen in the keeping of records of tree performance in Satsuma groves and in the inspection of groves which are sources or prospective sources of budwood to determine the Satsuma variety or varieties represented in the planting. This work has been carried on in cooperation with the Alabama State Board of Horticulture, which requires that citrus nurseries in that State use budwood only from trees of known performance and character.

The citrus bud-selection work in Florida is under a cooperative agreement with the Florida Agricultural Experiment Station. The plan consists in developing a "progeny grove" at the Lake Alfred Citrus Experiment Station, consisting of progenies of parent trees of known production and true to type for the variety. It is expected that the trees in this grove and additional trees budded from the best progenies will serve as a future source of budwood for growers and nurserymen that will be true to name and of productive strains of the best types for commercial planting. In connection with this work performance records are being kept in a considerable number of groves where the selected parent trees are located, and growers are assisted as far as possible in inaugurating a system of tree-performance records. Some work is also being conducted to secure greater uniformity in stocks, accomplished through vegetative propagation from superior parent trees of stock varieties.

**Rots.**—Preliminary tests were made of the effectiveness of ultra-violet light in the surface disinfection of citrus fruits with a view to controlling



blue-mold rot. It was found that almost all of the spores could be quickly destroyed at a reasonable cost, but there was no protection from later infection from spores that might remain unkilld or might reach the fruit later. A saturated solution of borax (sodium borate) applied to the surface of the fruit has shown a decided protective action against blue-mold rot and also has reduced stem-end rot.

**Canker eradication.**—The cooperative campaign for the eradication of citrus canker conducted in cooperation with Florida, Alabama, Mississippi, Louisiana, and Texas has progressed satisfactorily. No extensive epidemics of canker occurred in any of the cooperating States. The inspectors found the following new infections of citrus canker during the year: Florida, 1 grove tree; Alabama, 3 properties, 25 grove trees; Louisiana, 1 property, 110,000 nursery trees; Mississippi, 0; Texas, 19 properties, 854 nursery trees, and 174 grove trees.

#### DATES

Improvements in the technique of handling, curing, and packing dates of different varieties now grown on either an experimental or commercial scale in the Southwest, together with improvements in irrigation and agricultural practices and in the rooting and planting of offshoots, have established date growing as a promising fruit industry for the hot valleys of the Southwest. As a result of these investigations, continued progress has been made, especially in the handling of the Deglet Noor and Saidy varieties.

Although commercial date culture is now largely limited to the Coachella Valley in southern California, there is a very rapid increase of the industry in other hot irrigated valleys of the Southwest, particularly in the Imperial Valley of California and the Salt River Valley of Arizona, where large investments in date growing have been made during the past two years. A number of tests of date varieties have been undertaken in the Imperial and Salt River Valleys in cooperation with practical date growers.

#### SMYRNA FIGS

For many years this bureau has devoted incidental attention to the development of fig production in the Southwest. At the present time it

appears that the Smyrna fig industry is in a critical condition as a result of heavy losses from a fungous or bacterial disease which produces pink discoloration and rotting of the fruit. As yet no successful method of combating this disease has been suggested. It is known that it is spread through the agency of the *Blastophaga* insects which are necessary for the pollinization which results in the proper development of the Smyrna fig. New varieties of Smyrna figs have been developed by hybridization in the experiments carried on in the past 15 years. Some of these new varieties are of unusually good quality and have attracted the attention of fig growers, but their resistance to the new pink-rot disease is as yet unknown.

#### APPLES

In 1923 at Arlington Experiment Farm 138 apple trees which resulted from breeding work carried on several years ago with a view to developing better and earlier ripening summer apples produced a fair crop. Of these trees 39 were considered good enough in one or more particulars to be worthy of further testing. During the current season, 1924, there is prospect that further studies may be made on a large number of trees resulting from the early-apple breeding work, as many of them blossomed and set fruit. The earliest varieties to ripen in 1923 were in condition for cooking and eating on June 18. They are somewhat later this season.

In studying the vegetative propagation of deciduous stocks the roots of 900 No. 2 Yakima-grown apple seedlings were made into root cuttings and planted from the middle of February to early in March, 1923, at Shafter, Calif. The cuttings were 2 to 3 inches in length and were graded according to position in the root systems as first, second, third, and fourth cuts on the taproots and first and second cuts on the lateral roots. Shoots began appearing above the ground about three weeks after the cuttings were planted. Practically every cutting started to grow, but on account of heat and drought with inability to irrigate, many shriveled and died. However, in spite of unfavorable conditions in the beginning, many cuttings developed into strong trees, many of them ranging in height from 3 to 6 feet.

Small lots of seed of approximately 150 different varieties of apples were obtained. These were planted in



March, 1923, at the U. S. Horticultural Field Station, Bell, Md. Among the outstanding varieties, from the standpoint of seedlings produced, mention may be made of the Atsion, a variety about which little or nothing seems to be known, seeds of which were received from the South Haven (Mich.) Branch Station. The roots produced by seedlings of this variety were particularly long and smooth and considerably larger than the average. Seedlings of *Malus angustifolia* were among the best of any lot; they were especially vigorous, with green smooth roots.

Other varieties that produced good seedlings were Tolman Sweet, Ben Davis, Delicious, Florence, Northern Spy, and Winesap. This collection of seedlings included some 20 varieties of French crabs which are in the Arlington variety orchard. A good deal of variation occurred in the seedlings of the different varieties. Those making the strongest seedlings were Barbarie, D'Arroles, Rossignol, and Amere-du-Berthecourte. Selections of certain of the more promising individual seedlings were made, and these are being multiplied by root cuttings.

Oiled wrappers have come into general use on boxed apples to prevent rots and spots. They have not held scald completely in check in all cases, but they have caused such a marked decrease in the troubles from this disease that the trade is inclined to accept them as an essential feature of the apple industry. Experiments with shredded oiled paper have given fairly satisfactory control of scald in barreled apples, and this method will be used the coming year on a small scale by a considerable number of eastern growers. If well distributed through the package  $1\frac{1}{2}$  pounds of shredded oiled paper to the barrel was found satisfactory.

The importance of possible relations between the chemical constituents of the apple and storage scald in this fruit led to an investigation of the nonvolatile waxlike substances covering the epidermis. This work has been extended to include a study of the yellow flavonol pigment which occurs in apple peels. It is suggested as a result of these researches that quercetin or its glucoside, which has not been isolated, may be the caromogenic substance which is partly responsible for the formation of brown pigment in the peels of scalded apples. In connection with this investigation the pigment present in the flowers of elder has been isolated and identified.

## PEARS

Seedlings of *Pyrus ussuriensis* and *P. calleryana* 4 years old have been top-worked by budding the dessert varieties into the framework branches of the stock trees. The possibility of multiplying selected stocks by root cuttings has been given consideration. The highest degree of success, as measured by the stand of trees, is obtained when the root cuttings are made from 1-year-old trees. Cuttings from roots 2 years old and older have given poorer stands and less desirable root systems than those from the 1-year-old roots.

In the results with root cuttings no advantage appears in making them during the winter and storing them to callus. Equally good results have been attained the past year by making the cuttings in the spring and putting them immediately in the open-ground nursery row. In handling cuttings 2 inches long, it has been found that two men working together can easily plant in the open 2,000 an hour. The best stands are obtained where the cuttings are placed in an upright position with the top end barely covered with soil.

Laboratory inoculation tests on mature apples have brought about some interesting discoveries regarding the possibility of infection of the mature fruit with the pear-blight germ. Breeding pears to produce varieties that will afford a succession in ripening and the trees of which will be more resistant to blight than those now grown has been continued. Several hundred hand crosses were made in the spring of 1924 for the sake of securing new blight-resistant seedlings. Some 2,000 new seedlings were grown in the spring of 1924 and are now in the nursery at Arlington Experiment Farm as a result of the hand-pollination crosses made the previous spring.

Of the 100 or more varieties of pears received as a result of foreign explorations and tested during the past 15 years, a scant half dozen have proved worthy of more extended trial in the United States. As a result of preliminary tests it is believed safe to announce that all these pears are markedly blight resistant and produce fruits which, if not equal to the best of our dessert pears, are superior to many, if not all, of the oriental varieties now generally grown. It is believed that these pears should have widespread distribution, especially in the Southern States.

### APRICOTS

In handling apricots for dehydration, the rapid ripening of the fruit and the short harvest season have frequently curtailed the output of dehydrated fruit. While the practice of storing apricots at low temperatures has been utilized by the canners, it has not been considered practicable for dehydration purposes because of the supposed "cold-storage" taste of the stored product. In response to a demand for information as to the effect of storage upon the flavor of the fruit when dehydrated, experiments were carried on to determine the quality of the product after storage. The results of the experiments indicated that apricots for dehydrating may be held in cold storage with good effects upon color and quality of the dried product and without serious loss from decay during a period of three weeks or longer if the fruit is cooled promptly at 34° F.

In an effort to determine the proper stage of maturity for fresh shipment and the most effective methods of handling and refrigeration, an investigation of the handling and precooling of apricots was undertaken in the Santa Clara Valley, Calif. Experimental shipments of apricots picked at different stages of maturity were forwarded to New York and Chicago in express refrigerators and in freight refrigerator cars. The inspection of the fruit at destination and the inspection of similar fruit held in storage showed that green apricots picked after the fruit had developed to full size and was still "leaf green" in color did not increase appreciably in sugar content and retained an insipid taste and toughness after being held from four to six days in the market.

The experimental lots which were left on the tree until the fruit had reached a riper stage, approaching an "eating-ripe" condition, became over-ripe in transit and on holding in storage 12 days at a refrigerator-car temperature. This fruit was too soft at the end of this period to withstand handling and distribution in the market. Prompt precooling was effective to some extent in checking the early ripening and softening of experimental lots of tree-ripe apricots held in storage for inspection. Precooling gave a margin of two to three days in the safe shipping distance of the fruit in transit as compared with similar

lots of apricots which were cooled at the usual rate in a refrigerator car.

The experimental work has shown that for safe shipment over long distances it is necessary to select fruit that has developed a color stage intermediate between the leaf-green and highly colored fruit. The elimination of green and of overripe fruit either during picking operations or at the packing house is undoubtedly the most important factor influencing the soundness of the fruit in transit and at the time it is offered for sale. Care in the selection of the fruit, combined with careful picking and handling, was found to be of greater importance in affecting the condition of the fruit in transit than the precooling of the shipments.

### JAPANESE PERSIMMONS

The conclusion has been reached that of about 60 varieties of persimmons now growing in California many are of very inferior quality. A considerable addition to the acreage of this fruit has been made in the past three years, this increased planting being largely of the Hachiya variety. This is one of the astringent varieties, but it is of excellent quality when thoroughly ripened. Because of the necessity of its being thoroughly ripened and therefore too soft to carry before it is really edible, it is better adapted to local markets or to markets where the fruit is well known than it is to transportation to markets distant from the region of production. There can not be, however, very great expansion of production without developing a market beyond the limits of the State. It is believed that this can best be done with the so-called nonastringent varieties; that is, those which can be eaten while still comparatively firm. The varieties so far introduced that are best adapted to this purpose are Hya-kume, Miyotan, Fuyu, and Kurokuma. Some of these varieties need to be fertilized with pollen of other varieties in order to develop their nonastringent character, which is closely correlated with seed production, as they do not produce sufficient pollen themselves. The use of these varieties should be encouraged rather than the exclusive planting of Hachiya. Some of these varieties can be kept in a cool room until March, thus extending the season over a considerable period. The astringent varieties do not have as good keeping qualities as the nonastringent.



## GRAPES

The phylloxera was exceedingly destructive to *Vinifera* vineyards in California during the season of 1923. In the Dinuba and Orosi districts hundreds of acres of vineyards once flourishing but not on resistant stocks were uprooted on this account during the year. One of the important details coming out of the resistant-stock investigations is that some of the native American grapes which have been used more or less as resistant stocks and which in *Vinifera* regions are resistant to phylloxera and good producers themselves are not proving durable as stocks when *Vinifera* varieties are grafted on them. Again, some of the hybrid grapes that have been generally recommended by certain grape authorities as good resistant stocks are proving to be poorly adapted for such use. Such hybrids are represented by Mourvedre  $\times$  Rupestris No. 1202 and Chasselas  $\times$  Berlandieri No. 41-B, which according to present indications are not sufficiently resistant to phylloxera.

In the testing of varieties at the Government vineyards at Fresno and Oakville, Calif., attention has been given to the native American varieties in comparison with *Vinifera* varieties. The native American varieties in general in the experimental vineyards in 1923 corroborated the results of previous years to the effect that when grafted on resistant stocks heavier crops of choicer fruit of better shipping quality can be produced and at less expense than when grown on their own roots in the Eastern States.

There is considerable interest in the growing of *Vinifera* grapes under eastern conditions. In order to obtain definite information in regard to the adaptability of grapes of this type to eastern conditions and to provide means of studying their behavior in general a considerable number of varieties have been included in the experiment vineyard at Arlington Experiment Farm. While most of the vines there are young and do not as yet furnish information that is more than suggestive, the behavior of a considerable number of varieties thus far indicates that under the conditions prevailing in the vicinity of Washington *Vinifera* grapes if properly selected as to varietal adaptability may be grown successfully.

In the further studies of methods of growing the Panariti grape it has become evident that where the trunks

of the vines have been girdled for several years in succession the vines have become weakened, but where the girdling which seems necessary in order to produce satisfactory crops is confined to the arms and canes no weakening of the vines results.

Experimental shipments of pre-cooled and nonprecooled Malaga grapes forwarded from California to eastern markets when sold at auction brought 40 cents a package more when precooled as compared with similar packages not precooled. However, it yet remains to be determined whether this increased price represents an economic gain. No accurate determination was made as to the increased cost of precooling, including the overhead represented by the investment in the precooling plants.

The successful storage of Malaga grapes packed in sawdust until about January 1 would be of much value to grape growers in providing a new outlet for the increasing shipments of these grapes. The experiments made this season in the storage of Malagas indicate strongly that this variety may be safely held for about 60 days in storage if promptly cooled to about 32° F. after picking.

Investigations were made as to the effect of precooling Emperor grapes for storage purposes with a view to marketing them during the winter months. By prompt precooling to approximately 32° F. it was found that this variety can be held safely as late as February 1, or at least three weeks longer than similar fruit handled in the usual storage manner.

Work on grape diseases during the year has been carried on in Florida, where large plantings have been made and very serious losses from diseases have already occurred. Anthracnose and black-rot are very common and destructive. It has also been found that a rust (*Physopella vitis*), common on the native wild grape, also seriously attacks the cultivated grapes and in many cases causes defoliation before the vines have made a satisfactory growth. Spraying experiments conducted at Orlando, Fla., indicate that on some varieties at least the black-rot and anthracnose can be satisfactorily controlled by very thorough and frequent treatment with Bordeaux mixture.

## BERRIES

**Currant substitutes.**—Progress is to be noted in the study of fruits for jelly



making to take the place of currants and gooseberries, particularly in those sections where it is necessary to eradicate the two latter because of their relation to the spread of white-pine blister rust.

Cooperative tests of *Viburnum americanum* are being continued in different places, mainly at experimenting stations, for the purpose of studying methods of propagation and culture and with a view to selecting superior individual plants from the standpoint of their productiveness and merit for jelly making. A number of nursery firms have been supplied with seed of this fruit to enable them to replace the European form with which it has sometimes been confused, namely *V. opulus*, the fruit of which is inedible.

The bush cherry (*Prunus tomentosa*) from northern China, of which several introductions have been made by the department during the past 15 years, is beginning to receive serious attention at the hands of American horticulturists. Several thousand seeds of it from selected bushes were planted, and the seedlings are now growing at the Horticultural Field Station at Bell, Md. A considerable number of selected seedlings of bearing age at the Bell station have fruited this season. Rather high expectations for this fruit are entertained, because of the excellent quality of jelly obtained from the fruit, the wide range of adaptability of the species, and its vigorous growth, hardiness, and disease resistance. The plant is sufficiently hardy for cultivation as far north as Mandan, N. Dak. It makes rapid growth and commences to bear when 2 or 3 years old, and the fruit, which is produced in great abundance, is of excellent quality, resembling the sour cherries of this country in character and uses. By selecting those seedlings which bear most heavily and whose fruit is large and of fine flavor American plant breeders are rapidly improving the bush cherry.

**Breeding.**—During the season of 1923 crosses and hybrids were planted numbering 6,600 of raspberry and 800 of blackberry. Several thousand seedling strawberries were planted. Many of these are further developments from the more promising varieties which originated in previous breeding work. In the main the crossing which was done aimed to introduce into new varieties the desirable qualities of

some of the foreign sorts and also to combine varieties or species with a view to producing varieties having superior canning qualities. In previous work with strawberries some 246 selections were made with a view to their further fruiting and the beginning of additional study in 1923. Several very promising varieties have come out of the work thus far.

**Raspberries.**—In handling raspberries about four times as much decay occurred in the regular commercially handled fruit as was found in carefully picked berries from the same fields. After six days in storage under conditions approximating those of a refrigerator car in transit, carefully handled raspberries had developed less than 2 per cent of decayed and soft berries, while the regular commercial lots handled by the pickers showed 7.6 per cent. The effect of careful handling was even more evident after the fruit had been held for two days, following the 6-day storage period, under market conditions. The carefully handled lots after the 2-day period showed a total loss of 3.2 per cent of the berries from decay and softening, while similar commercial crates showed 17.3 per cent.

**Dewberries.**—Anthracnose and leaf-spot of the dewberry have caused severe losses on the plantations of North Carolina and South Carolina. Spraying experiments in cooperation with the North Carolina station have demonstrated the great benefit in the control of these diseases to be obtained by this means. Very large increases in the crop were harvested from the sprayed plats, and the growers expect to adopt spraying generally another season.

**Cranberries.**—Cranberry-disease investigations have been continued during the year, chiefly in Massachusetts, Oregon, and Washington. The work in Massachusetts has been devoted mainly to a study of the time of infection of the various fruit-rot fungi and to the effect of various bog treatments, such as flooding and reflowing, for insects. These studies have shown that flooding to destroy insects favors infection of the vines and fruit by fungous diseases. Studies of the false-blossom have been carried on to determine its rate of spread and the conditions favoring its development. It has been shown that in Massachusetts the method of water scooping practiced in Wisconsin greatly im-

pair the keeping qualities of the fruit. It is also shown that berries picked late in the afternoon keep better than those picked during the heat of the day. The work in Oregon and Washington has continued on the various diseases most prevalent and destructive there, especially end-rot, black-spot, and Sclerotinia. The life history of the end-rot fungus has been proved by pure-culture methods; likewise that of the black-spot fungus, whose identity has not heretofore been known. Spraying experiments this year have confirmed those of the previous year and have demonstrated that much benefit can be derived in the control of diseases and decay in storage by proper spraying.

### NUTS

#### PECANS

At the Pecan Field Station at Philema, Ga., nuts of 25 or 30 varieties and of selected seedlings have been assembled from a wide range of territory, graded according to size, and planted in nursery rows. During the year a larger number than usual of seedling pecans of promise have come to light.

Field spraying and dusting experiments for pecan scab have been continued. While this disease can largely be controlled by proper spraying methods, the results are not always satisfactory, especially when applied in commercial orchards. The disease is erratic in its occurrence and extremely subject to weather conditions, especially rainy periods. Experiments were continued to perfect still further routine spraying experiments and to obtain necessary data in order to make modifications to fit the various varieties and adapt the treatment to the changing weather conditions.

A study of the soil conditions obtaining in good and in poor orchards has been made. The experiments have been in orchards lying in the southern part of the pecan belt, particularly in southern Georgia. The results show that in general there is a very definite relationship between nut production and the general fertility of the soil and that this fertility is greatest in those soils containing an abundant humus supply. Associated with this increase in organic matter there is usually an increase in the nitrogen of the soil, and this has also been shown by fertilizer experiments with pecans to be the element of fertility of prime importance.

This organic matter in soils can be increased by the application of stable manure and by growing green crops, such as cowpeas, soybeans, velvetbeans, beggarweed, and other leguminous plants, although rye can also be grown during the winter months. Cowpeas, while desirable from a soil-fertility viewpoint, however, can not be recommended, because this crop has been found to harbor the stinkbug, which is the cause of the kernel-spot of the pecan. The growing of these leguminous crops has been shown to improve old and impoverished orchards and to increase materially the general soil fertility, especially when used in conjunction with commercial fertilizers which our experiments have shown to be profitable.

#### CHESTNUTS

The collection of hybrid chestnuts at the Horticultural Field Station at Bell, Md., is being studied carefully from the standpoint of the possible value of individual trees for nut production as well as with respect to their resistance to chestnut blight.

#### ALMONDS

Information on almond varieties has been assembled which will make it possible for the industry to meet many of the difficulties that are now being experienced incident to the occurrence of a great number of undesirable varieties in the trade. The study of almond seedlings has been disappointing, in that most of them are inferior. A few have been located having qualities that may be of value in breeding. About 2,000 nuts resulted from the breeding work which was done in the spring of 1923. This work is in cooperation with the University of California at University Farm, Davis.

#### PERSIAN WALNUTS

Results thus far indicate that self-sterility does not exist in the Persian walnut, at least so far as varieties have been investigated. Parthenocarp apparently occurs frequently, but is more common in some varieties than in others. In the search for better walnuts among the seedlings the outlook is more promising than with almond seedlings.

#### PISTACHE

During the past year additional confirmation of the possibility of grow-



ing the valuable pistache nut in America on a commercial scale has been obtained. The varieties grown in the Mediterranean region do not split properly when grown in California and Arizona, but certain new varieties of Persian origin split perfectly and, furthermore, give large yields. It is confidently believed that the pistache will form the basis of a profitable commercial industry in certain districts in California, Nevada, Utah, Arizona, New Mexico, and Texas having favorable soil and climate. For many years past the bureau has been carrying on experiments with wild species that make excellent stocks on which to graft the cultivated pistache nut. Like many other new industries the pistache did not give much promise of succeeding commercially for the first 10 years or so after its introduction, but now it looks distinctly promising.

## VEGETABLES

### POTATOES

**Breeding.**—Studies of the sterility of potatoes conducted in cooperation with the New York Botanical Garden have shown that the chief causes of sterility in the commercial varieties of potatoes are premature abscission of the buds or blossoms and imperfect pollen. Referring to some of the particularly interesting lines that have been under investigation during the past year, it may be noted that several wild species of tuber-bearing solanums were grown in the greenhouse at Presque Isle, Me., and crosses have been made between a few of them and some of the seedlings developed previously in the breeding work. The testing of seedlings resulting from the breeding work has been continued with a view to determining their value as commercial varieties.

**Seed - stock improvement.**—Additional studies have been directed toward more completely eliminating diseased and weak plants from seed stock. The new line of selection has been designated as the "tuber-index method," and the results last year were promising. Studies into the possibility of abridging the rest period of newly harvested potatoes through treating the cut surface with nitrate of soda, ammonium nitrate, potassium nitrate, and other substances have been undertaken during the year.

**Varieties immune to wart.**—In further tests for immunity to potato wart 16 French and 5 German varieties were found to be immune but not equal in productiveness to American varieties. A noteworthy addition was made to the list of American immune varieties in the Russet Burbank, which is also the most resistant of our varieties to potato scab and is well adapted to culture in the wart-infested areas, where scab is also a serious trouble. In general, those varieties which are immune and those which are susceptible fall into distinct horticultural groups. It has been found that wart does not readily spread from one area to another. Studies on the heredity of immunity to wart show this to be a dominant character and not linked with undesirable characters, giving assurance of success in the production of an immune strain of a variety of the Rural group.

**Virus diseases.**—Results of the work of the past season on the virus diseases of potatoes (mosaic, leaf-roll, spindle-tuber, etc.) indicate: (1) That all the important commercial varieties are subject to one or more of these diseases; (2) that these diseases spread more generally in southern potato fields than in the northern seed-growing sections; (3) that the extent of spread from diseased to adjacent healthy fields differs in various localities, but in general insect-borne diseases increase as the distance from diseased stock decreases; (4) that under isolated conditions the percentage of disease in partly diseased stock can be reduced very materially through rigid field inspection and careful roguing throughout the growing season.

**Scab control.**—Early scientific experiments showed that there was a definite relation between the prevalence of potato scab and the soil reaction or soil acidity and that the organisms causing scab flourish up to a certain point in this acidity and are prevented from developing by an acidity greater than this point. Other experiments showed that this soil acidity could be controlled by treatment, using fertilizers which by experimentation had been proved to have a tendency to increase soil acidity and avoiding such fertilizers as had been experimentally shown to decrease soil acidity. The use of sulphur, which has been shown to be biologically oxidized in the soil to acid, has given a further means of increasing soil acidity to the point where the scab organism can not func-



tion. Experiments have therefore been made with a number of fertilizer substances and with sulphur in several soil types, and these tests clearly show that potato scab can be controlled and that it is possible to renovate scabby ground so as to produce clean tubers. Too great an excess of acidity must be avoided or the potato plant itself will be injured, and in each case the quantity of sulphur to use should be determined experimentally. It is, however, safe in all cases where scab exists to use a fertilizer which has an acid-forming tendency rather than one which makes the soil less acid. Ammonium sulphate in fertilizers usually has an acid reaction, and the use of nitrate of soda tends toward an alkaline reaction in the soil.

**Transportation.**—During January and February an investigation was made as to the existing conditions in the transportation of potatoes from Maine. The result proved the inefficiency of the temporarily lined box car, which allowed for extreme fluctuation of the temperature and afforded little protection from freezing. It demonstrated the efficiency and slightly cheaper cost of operation of the refrigerator car heated with charcoal and for short hauls the efficiency of the preheated refrigerator car. Fortunately, an ordinary normal weather condition for the season of the year was encountered. During loading the temperature dropped to 16° below zero F., rising from that point gradually until a temperature of about 32° was registered at destination.

### SWEET POTATOES

**Seed stocks.**—Several hundred lots of seedling sweet potatoes grown at Arlington Experiment Farm during the summer of 1923 were harvested, and some of these show considerable promise. These seedlings were produced from seed grown in the Virgin Islands through a cooperative arrangement with the experiment station there and consist of crosses between some of the best-known commercial varieties. The selection of propagating stock of the more important commercial varieties was continued at Arlington. This work has resulted in securing stocks which reports from cooperators in the field show to be superior in vigor, type, and productiveness to planting stock ordinarily available.

**Diseases.**—Studies of the resistance of sweet-potato varieties to black-rot and

stem-rot have shown during the past season that out of 22 varieties tested none was immune to black-rot, and but few varieties showed any considerable resistance to stem-rot. With the exception of foot-rot the same diseases that are destructive to this crop in the East were found present to a serious extent in California sweet-potato sections.

**Storage.**—Shrinkage and decay tests of standard varieties of sweet potatoes, including Porto Rico, Nancy Hall, Dooley, Pumpkin "Yam," Triumph, Yellow Jersey, Big-Stem Jersey, and Gold Skin, at temperatures ranging from 45° to 50°, 50° to 55°, 55° to 60°, 60° to 65°, and 65° to 70° F. are being continued. From a commercial point of view temperatures of 50° to 55° have been found best, giving minimum shrinkage and decay.

**Fertilizer experiments.**—Fertilizer experiments with sweet potatoes have been made in the vicinity of New Bern, N. C., on the Portsmouth sandy loam and in the vicinity of Beaufort, N. C., on the Norfolk sandy loam. The plan is to determine the best ratio of phosphate, potash, and nitrogen economically suitable for the production of the sweet potato and involves also a study of the most profitable quantity to use and the nature of the plant-food carriers best adapted to this crop. These experiments are similar to the ones carried on previously with potatoes in the same regions, where it was shown definitely what fertilizer formulas were best suited to the locality, with the result that farmers in these places have been able to use a fertilizer of much cheaper composition than formerly in obtaining the best crop yields. A point especially noteworthy in connection with the potato was that the experiments showed a lower potash requirement than had formerly been used in the practice of the region. The results with sweet potatoes so far clearly indicate that this crop requires a higher potash content in fertilizers than does the potato, profitable results being obtained with proportions as high as 10 per cent.

### TOMATOES

Tests of several tomato varieties for resistance to Fusarium wilt were made in California, with the result that a number of varieties proved to be very resistant. Norton was most promising and appeared to be well adapted. The wilt-resistant Marvel

has proved to be also resistant to nail-head spot and will be used in breeding strains resistant to this disease adapted to the tomato-growing districts in Florida where it has recently caused serious losses. A practical and economical method of control for Septoria leaf-spot by plowing under dead tomato vines and weed hosts in the fall, coupled with clean culture and spraying, has been developed.

#### CUCUMBERS

Further experiments in Wisconsin and Illinois on the control of cucumber mosaic by the destruction of wild hosts were markedly successful. The perennial wild groundcherry was found to be an additional agency in carrying the disease over winter in Wisconsin, and it must be included with the wild cucumber, milkweed, and pokeweed as a source of mosaic infection. In southern Illinois pokeweed was found to be the chief apparent source of the disease. Successful methods of control for cucumber mosaic in greenhouses were demonstrated and the information made available to growers.

#### BEANS

Extensive tests for resistance to the principal bean diseases made the past season included a large collection of bean varieties as well as selections and hybrids resulting from the breeding work of the previous season. A number of the foreign varieties proved to be apparently very resistant to anthracnose and bacterial blight, but these will have to be crossed with American varieties to secure earliness and eliminate running plants.

#### SWEET CORN

In canning investigations a rather comprehensive study of sweet corn was undertaken, based on 15 varieties of sweet corn and 2 varieties of field corn, samples of which were canned at 15, 20, 25, and 30 days from day of silking. These canned samples were compared with each other to determine what stage of maturity was best and to what extent some varieties are superior to others. The toughness of the kernels at different stages of maturity and of different varieties has been studied by means of a specially constructed instrument which measures the resistance to puncture.

#### PEANUTS

The production of high-grade peanuts is largely dependent upon correct methods in handling the crop. Within recent years marked progress has been made in the development and distribution of improved seed stocks.

About 30 strains, including all the recognized varieties and several which are sufficiently well defined to be designated as varieties, were grown in increase plats at Florence, S. C. From 30 to 150 ideal hills were selected from each of these increase plats. These selected hills were picked and placed in one lot to serve as stock seed for additional selection work. This work has been in progress for several years and has resulted in the production of superior strains of Virginia Bunch, Virginia Runner, Jumbo, Improved Spanish, Spanish, Valencia, African, and other varieties and in addition to these a number of distinct strains not resembling any existing variety.

Seed stocks from the increase plats are being distributed to various individuals and agencies. The work has progressed to the point of entering into an agreement with cooperators for the production of several acres of seed peanuts, using our stock seed as a basis.

#### LETTUCE

Trials of 18 varieties of head lettuce made in the greenhouse at Arlington Experiment Farm during the late winter of 1923-24 indicated that only 5 or 6 of these are at all adapted to greenhouse work. Selections have been made from these few promising ones, and these selections are being carried to the seed stage with the intention of planting this seed for the production of a crop from which additional selections will be made, in the hope that a superior strain of each adapted to greenhouse conditions can be developed.

The two strains of loose-leaf lettuce developed during the years 1918 to 1922 have been tried in many parts of the country and are looked upon as of high quality.

Work on lettuce shipping was undertaken to determine the efficiency (1) of body icing, that is, placing ice in the body of the car on the lettuce as against bunker icing or placing the ice in the bunkers of the car, without ice in the crates, under standard refrigeration; (2) with ice in the crates, no ice on top of the load, and



under standard refrigeration; and (3) the usual method followed in the Imperial Valley of placing ice in the crates, about 4,800 pounds on top of the load, and no ice in the bunkers. It was found that the car without ice in the crates or on top of the load under standard refrigeration did not carry satisfactorily and was in very bad condition when unloaded at market. The other cars were about equal in quality. The conclusion is that lettuce will apparently carry as well from the Imperial Valley in the winter with ice in the crates and none on top of the load under standard refrigeration as it will with ice in the body; that is, bunker icing with ice in the crates is apparently as efficient as body icing in cooling the lettuce.

### CABBAGE

A valuable method of hot-water treatment of cabbage seed for the control of black-leg has been worked out and made available to growers. It was used on a comparatively large scale by a number of growers in 1923 with complete success. Varieties resistant to yellows have been selected. These include strains of All-Head Early, Glory-Copenhagen, and Late Round Red and an improved type of Wisconsin Hollander.

### CAULIFLOWER

During the year additional tests of strains of cauliflower have been made in the greenhouse and in the field. Two strains have proved to be of very high quality. It has been shown that a sufficient quantity of seed can be grown in limited greenhouse space for the planting of a large outdoor acreage; in fact, one or two greenhouse ranges could produce enough seed for the needs of the commercial industry. Tests of cauliflower seed from Puget Sound showed it to be of a poor strain. If the cauliflower-seed industry is to be developed in that or any other region of the United States it must be with a strain of superior quality.

A successful crop of cauliflower seed has been grown in one of the houses at Arlington Experiment Farm. This is from two of the more promising strains developed at the farm during the past few years and probably represents the highest grade of cauliflower seed now available from any source. The production of cauliflower seed in the greenhouse, using this stock as a foundation, for the use of

growers in the production of the outdoor and the greenhouse commercial crop throughout the United States, would seem to be entirely practicable, awaiting only the interest of commercial growers in a position to carry on the work.

Investigations of cauliflower ring-spot in California have shown that a very high humidity and a relatively low temperature are necessary for the development of this disease. No variety out of a large number tested showed any material resistance to ring-spot. Spraying was found impracticable for control in the conditions under which cauliflower is grown in California, and it was demonstrated that yellowing of the leaves in transit is not associated with ring-spot.

### CELERY

Experiments with celery fertilizers were begun this year in cooperation with the Florida experiment station and the celery growers of Seminole County, Fla. These tests are so planned as to cover such questions as the quantity of fertilizer which can profitably be employed; the composition of the fertilizer as to the nature of the materials to be employed, with special reference to the various nitrogen carriers, both organic and inorganic; and the ratio of the proper plant-food constituents, such as phosphate, nitrogen, and potash, for the best yield and best quality of celery. The quantity of fertilizer which can apparently be used with profit under these soil conditions exceeds those usually employed elsewhere, and in the experiments a very profitable return was obtained with fertilizers up to 5 tons per acre, which was the largest quantity tried this first year. It was also observed that the percentage of the larger commercial-grade celery increased progressively with the increase in the quantity of fertilizer.

These experiments indicate that the growth of celery is determined (1) by the percentage of ammonia in the fertilizer and (2) by the potash content, the phosphate content being of minor importance. Mixtures of the inorganic sources of ammonia, nitrate of soda and ammonium sulphate, gave this year as large returns in crates per acre as mixtures containing organic nitrogen materials, such as cottonseed meal, dried blood, tankage, and fish scrap. The best results were obtained usually from those mixtures



which included materials from all of these sources.

## CEREALS

### WHEAT

**New foreign varieties.**—In the course of foreign explorations for barleys collections of wheats also were made in Algeria, Tunis, Egypt, India, Abyssinia, and Spain. The total number collected was almost as great as that of the barleys. The variation, however, was not so marked. Wheats were found over the entire plateau of Abyssinia, although this has not been looked upon as a wheat-growing country. Many of the varieties obtained were brilliant purple in color. Emmer was found in Abyssinia at altitudes where ice was formed beside the fields very frequently and possibly every night. The plants were in all stages, from flowering to almost mature, but seemed unaffected by the low temperatures.

**Shepherd strain.**—The Shepherd strain of soft red winter wheat which has proved highly resistant to both flag smut and rosette was developed at the Arlington Experiment Farm. About 100 acres were sown in the infected area in southwestern Illinois in the fall of 1923. From the product enough seed should be available to permit the sowing of a large area of this resistant variety in the fall of 1924.

**Rosette.**—Investigations conducted in cooperation with the Wisconsin and Illinois Agricultural Experiment Stations show that (1) the cause of wheat rosette still remains undetermined but indicate that *Helminthosporium sativum* is not the cause and that its occurrence on rosette-diseased plants is secondary; (2) the use of rosette-infested soil clearly indicates that winter-wheat plants become infected in the fall very soon after the seed germinates; (3) the use of resistant varieties of wheat on infested land has continued to give highly satisfactory control of the disease.

**Take-all.**—Many varieties of winter wheat, spelt, and emmer are highly susceptible to take-all, as shown by investigations in cooperation with the Kansas, North Carolina, and Wisconsin Agricultural Experiment Stations. Barley is fairly susceptible, but less so than wheat. Rye and oats seem to be immune. The causal fungus (*Ophiobolus graminis*) attacks the wheat plants at all stages of their develop-

ment, but the plants are more susceptible in the seedling stages. Relatively low soil temperatures apparently favor the development of the disease.

**Scab.**—Investigations in cooperation with the Wisconsin Agricultural Experiment Station show clearly that (1) wheat heads are most susceptible to the attacks of the fungus (*Gibberella saubinetii*) when they are in the full-bloom stage, and (2) scabbed wheat kernels are low in sugars, starch, and pentosans, these substances being used by the invading fungus.

**Leaf rust.**—Field and nursery studies show that the intensity and spread of leaf rust are directly dependent on winter survival of the rust organism. Nurseries containing from 46 to 299 varieties of wheat, representing the most promising resistant selections of those previously tested, were grown at Arlington Experiment Farm and co-operatively with the State experiment stations of Kansas, Tennessee, Georgia, Indiana, and Wisconsin. The durumms and emmers, in general, showed high resistance. Some of the spelts were susceptible. All club wheats included were highly susceptible. The common wheats showed a great variation in susceptibility. Strains of Poole, Red Rock, and Fultz showed marked susceptibility. Certain strains of Fulcaster, Michigan Amber, and Michikoff were less susceptible, and some strains of Turkey and Kanred showed various degrees of resistance. Several of these and others especially selected for the purpose showed considerable variations in susceptibility in the different nurseries, indicating strain differences in the rust, a fact of great importance in breeding for rust resistance. Similar investigations were conducted in the greenhouse during the past winter.

**Bunt, or stinking smut.**—Weekly sowings of a susceptible variety in Kansas indicated that little infection with bunt took place until the mean daily soil temperature had fallen to about 40° F. Below that point smut infection increased until a minimum of about 27° F. was reached. At both high and low soil temperatures the percentage of infection increased and decreased in direct proportion to the moisture content of the soil. At Arlington seed of Purplestraw inoculated with both species of bunt was sown at weekly intervals from October 8 until December 20, 1923. More than 90 per cent of the plants in the earlier sowings were infected. The December sowings showed a decided

decrease in infection. Controlled soil-temperature experiments indicate that infection can occur at 10°, 15°, 20°, and 24° C., but not at 28°. The same temperature relations have been determined for flag smut of wheat.

Seed-treatment experiments have been continued with the fungicides which gave promising results in previous experiments and with a few additional compounds. Copper-carbonate dust continues to show its superiority over other materials on the Pacific coast. It controls bunt, is easily applied, and causes no seed injury. There is some evidence that it stimulates early seedling development and may increase the ultimate yield. Bunt was controlled by copper carbonate at Arlington in 1923. Copper-sulphate-lime dip and organic mercury compounds commercially distributed under several trade names also controlled bunt.

**Stripe rust of cereals and grasses.**—In cooperation with the Idaho Agricultural Experiment Station additional evidence has been obtained to show that the mycelium of the stripe-rust organism may overwinter on the leaves of certain perennial grasses and probably also on winter wheat. Heavy spring development of stripe rust is dependent upon weather conditions of the preceding summer and fall. If these conditions do not favor heavy and general fall infection of grasses and wheat, very little stripe rust will develop the following spring.

#### BARBERRY ERADICATION TO CONTROL BLACK STEM RUST OF WHEAT

The campaign for the eradication of the common barberry is conducted in cooperation with the State agricultural college in each of the 13 States cooperating, with the State department of agriculture in most of them, and with the Conference for the Prevention of Grain Rust. It was begun in a preliminary way in the spring of 1918 and has completed its sixth full year. The three different phases of the campaign, education, survey, and eradication, have been conducted throughout the year 1924 in each State.

The yearly appearance of severe local epidemics of stem rust, which were traced to barberry bushes remaining in certain counties previously surveyed and thought to be clean, made a second complete survey advisable in several counties.

It probably will be necessary to make a second survey in all counties

in which many fruiting bushes have been found, as numerous seedlings may be expected to develop from the scattered seeds. It also may be advisable to survey a second time all counties in which wheat is the principal crop.

**Escaped bushes.**—The spread of escaped barberries to open woodlands, fence rows, rocky ledges, brushy pastures, and stream banks is the most serious problem of the campaign. Not all bushes among undergrowth and weeds are found on the original survey and some may be overlooked on the first resurvey. Seedlings continue to appear each spring for a number of years after all fruiting bushes are destroyed. A total of 3,600,669 escaped bushes has been found on 4,717 properties to date. In addition, most of the 3,825,478 seedlings found on original surveys and resurveys were in areas of escaped bushes.

The greater number of properties on which escaped bushes were found were in the more humid States of Wisconsin, Illinois, Iowa, and Michigan, in the order named. However, some escaped bushes have been found in each State. The eradication of all bushes and seedlings from areas of escaped bushes is progressing as rapidly as possible. Many small areas appear to be cleaned. The complete clean-up of many larger areas is in sight, largely through the general use of crushed rock salt as a killing agent.

**Chemical eradication.**—Experiments on chemical methods of eradication begun in September, 1921, have given excellent results. Two chemicals, rock salt and a sodium-arsenite solution, have been successfully used. The sodium-arsenite solution proved dangerous to livestock and poultry, and its use has been discontinued. Crushed rock salt and flake or packers' salt have proved effective and may be applied at any time of year.

**A native harmful barberry.**—A native species (*Berberis canadensis* Miller) occurs abundantly in the Appalachian Mountains of southwestern Virginia, southern West Virginia, and western North Carolina. It is susceptible in nature and spreads stem rust to grains. In some localities at least it is as much a menace to the growing of grain as the common barberry. In 1923 numerous clumps of bushes of this species were found scattered along the Timpacano River in Pulaski, White, and Carroll Counties, Ind. Bushes were not found in woodlands and fence rows of near-by farms.



The occurrence of this species also has been reported from southern Missouri and northern Arkansas. Limited experiments in both Indiana and Virginia show that plants of this species may be eradicated by the application of salt about the crown.

**Barberry species and hybrids.**—A *Berberis* garden has been established near Bell, Md., wherein all known species, foreign and native, and hybrids of *Berberis* are being assembled for description and classification. All of these species and hybrids are being tested at St. Paul, Minn., under controlled conditions, to determine their susceptibility to stem rust. In this way the sale and growing of susceptible introductions and hybrids will be avoided.

**Summary.**—During the past year an area equivalent to approximately 183 counties was covered in the original survey, 271 counties in the resurvey, and about 53 counties in the second survey. On the original survey 227,413 bushes were found on 7,129 properties, and 248,483 bushes were eradicated from 8,895 properties. These included 4,433 bushes found on 324 properties on a second survey of about 53 counties. On resurvey 98,065 sprouting bushes were found and 97,572 eradicated. A total of 3,716,097 seedlings was found and 3,666,203 eradicated on original survey, resurvey, and second survey. This gives a grand total for the fiscal year of 4,041,575 bushes, seedlings, and sprouting bushes found and 4,012,258 eradicated.

## FLAX

**Flax-wheat mixtures.**—A method of growing flax and wheat as a mixed crop, developed by farmers in southeastern Minnesota, has been fully investigated and found to be desirable and profitable under some conditions. Satisfactory results with this mixed crop were obtained in rather extensive experiments conducted in 1923 by this bureau and the State agricultural experiment stations of Minnesota and North Dakota. This mixture of the two crops holds weeds in check, prevents heat canker of the flax seedlings, makes the flax crop easier to handle with the grain binder, and at the same time increases diversified cropping.

**Increased acreage.**—Unprofitable returns from wheat growing have made further diversification very desirable in the spring-wheat belt where flax is extensively grown. The prevalence

of flax wilt and other diseases and the lack of new wilt-free land had caused flax growing to decrease, so that the average area grown in the past 10 years has been scarcely more than 1,500,000 acres, with an average production of 10,000,000 bushels, or scarcely more than one-third of our domestic needs. Flax, therefore, seemed a desirable diversification crop to recommend. As a result of Federal and State encouragement the seed-flax area in 1923 was increased to 2,061,000 acres and the estimated production to 17,429,000 bushels. The average acre yield of  $8\frac{1}{2}$  bushels, with a good price throughout the year, made the crop fairly profitable to growers. The Federal and State agencies did not attempt to increase the acreage in 1924, but only to stabilize the gains made in 1923. Preliminary estimates for 1924 indicate, however, that about 3,375,000 acres have been sown, or an increase of approximately 63.6 per cent over 1923. Much of the increase of the past two years has been on old land instead of newly broken sod. This has been made possible by a better knowledge of the wilt and the production of wilt-resistant varieties, especially North Dakota Resistant No. 114, developed by the North Dakota station. It was estimated that in 1923 about 26 per cent of the North Dakota crop was grown on sod and 74 per cent on older land.

## OATS

**Natural crossing.**—The oat plant has been thought to be self-fertilized. Studies of oats at the Akron Field Station in Colorado indicate that natural crossing occurs more frequently than has been suspected by previous investigators. This probably accounts for much of the variation which has been observed in supposedly pure lines. It is evident that strains intended for use in hybridization experiments should be carefully selected for genetic purity for several generations before being used in making crosses.

**Stem rust.**—Uniform oat nurseries containing 11 varieties of cultivated oats were grown at 21 experiment stations in 1923. They showed that White Tartar (White Russian), Green Mountain (differing from White Tartar only in having more awns), and Richland (Iowa No. 105) were outstanding in rust resistance. These varieties were consistently resistant in all the experiments conducted in 11 States.



**Crown rust.**—The investigation of crown rust of oats and related wild grasses was continued in cooperation with the Iowa Agricultural Experiment Station. The degree of infection on numerous *Rhannus* species which serve as alternate hosts for crown rust was increased in 1923, indicating that all species infected may be able to produce aecia under certain ideal conditions.

Through the cooperation of the State leaders of barberry eradication and their numerous assistants, a preliminary survey for the location of the common buckthorn (*Rhannus cathartica*) in the upper Mississippi Valley was made possible. The following table presents a summary of the number and locations of common buckthorn found in the summer and autumn of 1923:

*Plantings of common buckthorn found in eight States in the summer and autumn of 1923*

State	Number of plantings			Bushes counted	Bushes not counted (length of hedge)
	City	County	Total		
Illinois.....	41	35	76	Number	Feet
Indiana.....	1	1	2	40,901	2,725
Iowa.....	23	35	58	2	106
Michigan.....		2	2	4,083	5,036
Minnesota.....	354	38	392	2	106
N. Dakota.....	37	54	91	14,120	8,790
S. Dakota.....	175	19	194	6,669	3,395
Wisconsin.....	1	4	5	23,335	14,072
Total..	632	188	820	89,496	34,018

**Covered smut.**—Markton, a selection from an unnamed variety of oats with yellowish white kernels, has been found to be immune from covered smut. It has been the highest yielding variety at the Sherman County Branch Station, Moro, Oreg., and at the Washington Agricultural Experiment Station at Pullman. The original lot of seed was obtained in 1904 from an exhibit of Louis Dreyfus & Co., at the Louisiana Purchase Exposition, the original source of the variety having been reported as Dedegatch, Turkey. The discovery of immunity from covered smut in a variety with desirable kernel characters in combination with high yielding power is a decided step toward a solution of the smut problem in oats. Markton already is being grown commercially in eastern Oregon, the seed having been distributed to

some extent from the Sherman County Branch Station during the last few years. Limited quantities have been sent to farmers of Washington by the State Agricultural Experiment Station. A much larger distribution will be made in that State in 1924 in the hope of reducing the serious injury caused to the oat crop by covered smut.

## CORN

**New varieties from South America.**—Corn varieties were obtained near La Paz, Bolivia, and in the vicinity of Cuzco, Calca, and Huancayo, Peru, that have been grown in these localities since long before the discovery of America by white men. These varieties possess many characteristics which make them of interest and possible value as breeding stocks in the United States. These districts are located near the Equator (from 12° to 17° south latitude) and so have a long frost-free period except at the highest altitudes. For the same reason the length of the days and nights is more nearly equal than in our Corn Belt. Because of the altitude, however, the temperature is relatively low, particularly during the night. These conditions have resulted in varieties of corn differing markedly from those grown in the United States. Some of the strains, though received late in the spring, were planted in the hope of making crosses with United States varieties in the season of 1924.

Angol, Temuco, Gorbea, and Cura Cautin, Chile, were also visited and samples of corn obtained. The varieties grown in this section of Chile for the most part are like those grown in Argentina. There are one or two flint varieties, however, that appear to be native and may have some value in the United States because of possible adaptation to cooler nights during the growing season.

**Breeding.**—Two methods of breeding as applied to corn have been under investigation for a number of years. Starting with the same stock of seed, the most approved method of selection and cross breeding has been compared with a method of isolating and combining the highest performing selfed strains. An extensive field comparison of the results of these two methods with each other and with the results of bulk selection of open-pollinated seeds shows that both breeding methods have given decided increases over the method of bulk selection. Contrary to results of a less extensive comparison made last year, the cross-breeding method outyielded the selfed method by 10 bushels per acre, or 20

per cent. While the method of cross breeding selfed strains provides a vigorous and uniform stock that is free from obvious defects, it is clear that in eliminating the defective strains something that makes for the highest performance was lost in this experiment.

Crosses between self-pollinated strains with unusual shuck development have shown that good yields can be obtained along with this character and that ears well protected by shucks are practically immune from the attacks of the black or rice weevil when other insects do not open the way for its entrance. Data also were obtained in these experiments which indicate that some of the strains used in the crosses carry resistance to attack by the sugarcane borer, an insect that causes much damage to corn in parts of the South.

**Waxy maize.**—The peculiar type of carbohydrate known as erythrodextrine reported from a Chinese variety of maize is apparent even in the pollen, which in this variety stains with iodine red instead of blue. This fact affords the unique opportunity of witnessing Mendelian segregation in the formation of the pollen of a hybrid. The two kinds of pollen have been observed in crosses with perennial teosinte, which has double the chromosome number of maize and affords a possibility of identifying the particular chromosome which carries the determiner for endosperm texture.

**Heritable characters not fixed by selection.**—A study of the inheritance of a peculiar type of branched ear discovered in a strain of maize grown by the Pawnee Indians shows the character to be inherited, and although the character is alternative it is not possible to fix its expression by selection. Recognition of this type of inheritance is of importance, since many economically important characters are of this type.

**Linkage relations.**—The study of linkage relations in maize is being continued. It has been found that the degree of linkage between two characters located on the same chromosome, previously shown to be different in the two sexes, changes with the age of the individual and is profoundly influenced by environmental conditions. To understand and control these conditions is a first step in directing genetic changes.

**Root, stalk, and ear rots.**—The *Diplodia* dry-rot (*Diplodia zeae*) was especially common in the fall of 1923, owing to the wet fall and the abun-

dant presence of the fungus. Heavy losses resulted, and disease-free seed corn was difficult to procure. This fact, together with the late wet spring, has made this disease especially important, as experiments conducted cooperatively in Wisconsin have shown that high soil moisture is most favorable for the development of this seedling blight.

Extensive experiments conducted in cooperation with the Illinois Agricultural Experiment Station and the Funk Bros. Seed Co., Bloomington, Ill., to determine the effectiveness of different seed treatments for the control of the seed-borne infection by *Diplodia*, indicate very promising possibilities for a number of the newer treatments. Indications, however, are that even only slightly infested seed given the best seed treatment is somewhat inferior to the best disease-free seed.

**A bacterial disease.**—Investigations in cooperation with the Illinois Agricultural Experiment Station and the Funk Bros. Seed Co. have shown the occurrence of a bacterial disease of field corn which is somewhat similar to bacterial wilt, or Stewart's disease, but distinctly different from it. Pure-culture inoculations have shown the associated organism to be pathogenic and able to reduce markedly the yield of good corn. Control measures are being investigated.

## BARLEY

**New foreign varieties.**—Several early barleys were secured from the plains of India. Some of these give high yields and have good kernel qualities when grown in the Punjab. From Kashmir a collection of very different barleys was obtained. Most of the Kashmir barleys are fall sown. They must have some degree of winter hardiness, as Kashmir lies at an altitude of 5,000 feet, in the latitude of South Carolina. In all there were 19 accessions from Algeria and Tunis, 19 from Spain, 32 from Egypt, 30 from India, and 33 from Abyssinia. This does not in any way indicate the total number of barleys procured. Wherever the fields were in head all of the types from a single set of adjoining fields were selected but placed under a single field accession number.

The barleys from Algeria, Tunis, Egypt, and India were sown in November, 1923, at Sacaton, Ariz. In addition to the bulk samples more than 700 rows were grown from heads selected in fields of North Africa and



India. Many of these gave very high yields. The selections from Egypt were particularly promising. Some hundreds of selections were of the two forms of Mariout, and it is hoped that some of these may be superior to the original introductions. The barleys from Kashmir gave surprisingly high yields. It is thought that the Kashmir type has not been previously tested at experiment stations in America.

**Covered and loose smuts.**—In studying varietal resistance of barley to covered smut it was found that heavy infection could be obtained in Tennessee Winter barley by removing the hulls before inoculating. This experiment was repeated with 12 varieties in the greenhouse at Arlington Experiment Farm and equally positive results obtained. In Kansas it was found that soaking both hulled and hull-less barley seed in a 1 to 320 formaldehyde solution for two and three hours did not materially affect the germination of the seed and gave excellent control of both smuts.

### RICE

Results obtained from fertilizer experiments conducted on the Crowley silt loam at the Rice Experiment Station, Crowley, La., during the last five years show that commercial fertilizers do not give sufficient increase in yield to warrant their application. On the other hand, the results obtained from experiments on the growing of rice in rotation with the Biloxi soybean on the Crowley silt loam show that the physical character and fertility of the soil are greatly improved and that the yield and quality of rice also are greatly increased. As a result of these experiments the Rice Experiment Station last fall proposed an agricultural program for southwestern Louisiana. It was accepted by the rice growers, and the Louisiana State University appointed an extension specialist to develop this program in cooperation with the Rice Experiment Station and the parish agents of the rice-producing parishes in this section of the State. The proposed program, if conscientiously and persistently carried out, will result in the increase of rice yields without the use of commercial fertilizer and in the complete eradication of red rice without an acre of land being unproductive at any time.

Results obtained from experiments in water-grass control in California indicate that rice sown broadcast and immediately and continuously sub-

merged or rice sown broadcast in the water and kept continuously submerged produces much better growth and matures from 7 to 10 days earlier than under the old method of irrigation.

Experiments in growing rice without irrigation in Florida and southern Alabama show that land which is used in winter for truck crops in these States may be profitably used the following summer for rice.

### GRAIN SORGHUMS

A recently developed variety of blackhull kafir named Reed has proved to be the best yielder of all the kafir varieties at the Woodward Field Station in Oklahoma. It has excelled the others in the plats devoted to dates of seeding and rates of seeding, as well as in the varietal comparisons. Considerable quantities of seed were distributed from that station in the autumn of 1923.

Reports of severe infection of kernel smut in milo fields were received from Kansas, Texas, and New Mexico. Milo previously had been supposed to be practically immune from this smut. Seed from diseased heads received with the reports was sown and the resulting plants proved to be milo. An effort is being made to determine the cause of this unexpected development of kernel smut in milo.

In cooperative studies on varietal resistance of sorghums to kernel smut at the Kansas Agricultural Experiment Station several varieties grown from selected heads have remained free from smut while others have shown a high degree of resistance.

Copper carbonate, a number of commercial organic mercury compounds, and various modifications of the formaldehyde treatment have been used, and some excellent results have been obtained. The wet formaldehyde treatment was more satisfactory than the dry method.

### RYE

Rust-resistant rye selections, including 135 crosses between resistant plants and 141 selfs obtained from similar material grown in 1923, have been studied in greenhouse and field. Under both conditions, but especially in field nurseries, several selections appeared to be uniformly highly resistant.

### PHYSIOLOGICAL STUDIES

The determination of the constituents of the protein material in cereals has been continued. For the first



time in the history of cereals the polypeptides have been shown to occur in the ungerminated kernels of wheat, oats, and corn. The results are of added significance, since they have shown that the polypeptides and amino acids are necessary links in the synthesis of the proteins, the carriers of life functions in the plant, animal, and human organism. Germination experiments with maize seed, having as their object a systematic study of the fundamental physiological and biochemical laws involved, with a view to throwing additional light on the process of germination, are well under way in the greenhouse.

## SUGAR PLANTS

### CANE

**Breeding.**—Tests of about 3,000 sugarcane seedlings and imported standard varieties were conducted during the winter of 1923-24 at Canal Point, Fla. Crossing of varieties during December and January yielded a large quantity of seed, but most of the seedlings were lost during the cold weather following the blooming period, owing to lack of facilities for protecting the young plants. Many of the varieties shipped elsewhere for trial proved immune to mosaic and root-rot, the principal factors involved in the diminishing cane yields in Louisiana. Experiments on treatment of seed cane show that borer larvæ and mealybugs can be completely removed from the seed cane by immersion in hot water. In addition, a remarkable stimulation of the resulting plants was observed.

About 300 cane seedlings and standard varieties from the Canal Point Breeding Station in Florida were planted for trial at Houma, La., under Louisiana plantation conditions. Three varieties which have proved superior to native varieties are being rapidly increased for distribution to the planters in that locality next spring.

**Mosaic.**—During the year seven new wild hosts of sugarcane mosaic were discovered, and tests with sorgo and corn varieties indicate that many additional varieties of these cultivated crops are subject to this disease. The work on the deterioration of seed cane for the first year was completed on June 30, and the indications are that much of this deterioration may be prevented by storage under controlled conditions.

### BETTS

**Breeding.**—Sugar-beet breeding was continued at Salt Lake City, Utah,

along the same lines as last year. About 350 isolations of mother beets were made in the fall of 1923. In addition, studies by the plant breeder indicated large losses of sugar during storage of the beets, due to respiration and other physiological activities of the stored plants. The significance of these changes during storage in relation to the time for chemical tests of mother beets and in indicating the necessity for careful methods of storing commercial beets was brought out.

Experiments at Rocky Ford, Colo., on the effect of sugar-beet seed treatment with fungicides indicated increased yields by the formaldehyde-steam treatment, which, as a result, has been adopted commercially on a large scale.

**Fertilizer experiments.**—Fertilizer experiments with sugar beets in the Arkansas Valley have yielded results of considerable economic importance. Sugar-beet growing in the valley has been confronted by a number of changing soil conditions which the fertilizer experiments were planned to meet. This plan involves a study of the ratio of the various fertilizer constituents, such as phosphate, potash, and nitrogen, with a view to determining the best ratio suited to this region and whether the use of fertilizers would be profitable in these localities. One of the chief difficulties encountered has been the decreasing sugar content in beets since they were first grown, and the effect of this has been to embarrass greatly both sugar factories and growers. The experiments above mentioned have given most encouraging results in showing that certain fertilizer combinations not only increase the yield of beets per acre but also the sugar content in the beets themselves. The indication of tests covering several years has been that fertilizers high in phosphate bring about a profitable increase in the beets and in the sugar per acre. This is of particular interest, because phosphate is the cheapest of the fertilizer elements and the one most readily obtained in the western agricultural territory. Some new work is being inaugurated in Utah and in the sugar-beet section of Michigan.

**Curly-top.**—Investigations conducted for a number of years indicate that curly-top is transmitted by no insects other than the beet leafhopper (*Eutettix tenella* Baker), that the transmission is the result of this insect having fed on beets or on several species of weeds affected with the disease, and that when the ability to produce the

trouble is acquired by the leafhopper there is no evidence to indicate that it is ever lost during the life of the insect. A development of particular note in connection with breeding beets resistant to curly-top is that when the disease is transmitted to certain plants that are resistant (notably *Chenopodium murale*) the virus may be attenuated or modified and thus becomes less virulent when transmitted from these plants to beets.

## FORAGE CROPS

### LEGUMES

**Soybeans.**—Extensive investigations have been continued with the soybean to obtain satisfactory data for meeting the increasing demands for information relative to the culture, varieties, harvesting, and utilization of the crop. The growing interest in this crop is indicated by large increases in acreage and seed production. More than 200 new introductions have recently been received from Japan, Manchuria, and China to aid in the development of pure strains adapted to different sections of the United States suitable for forage, silage, pasture, and grain. Variety demonstration tests with new varieties developed by the bureau were carried on in every State except Nevada and Utah. No variety has done more to increase interest in the soybean in the Southern States than the Laredo, developed by the bureau for resistance to wilt and nematodes. In the North a pure strain of Manchu has given excellent results in demonstration tests. Several new selections in field-plot tests have given good results in comparison with standard sorts and are being increased for planting on a field scale. The Biloxi, Laredo, Mandarin, Virginia, Wilson-Five, Peking, Manchu, Black Eyebrow, Tokio, Haberlandt, Elton, and Habaro varieties, all developed by the bureau, were included in the certification seed work of various State crop-improvement associations.

**Cowpeas.**—Investigations were continued with cowpeas in the testing of introductions, crosses, new varieties, and selections and in conducting cooperative variety tests. The Victor variety, developed by this bureau, excelled standard sorts in field demonstration tests, especially on wilt and nematode lands. The Columbia, also developed by the bureau, gave excellent results in tests in the cowpea region, and as a summer cover crop in California it gave the best results. Work was con-

tinued in the selection of edible varieties of the white and black-eyed groups.

**Mung beans.**—Extensive variety tests with the mung bean were conducted in the Southern States to determine the resistance of this crop to the Mexican bean beetle and to obtain definite information as to its value in yield of forage and seed in comparison with other crops. Thus far the mung bean has proved to be immune to attack by the Mexican bean beetle.

**Alfalfa.**—Alfalfa seed has been imported from South America in large quantities during the past year. Supplies have also come in from Africa and elsewhere. Field and greenhouse tests have been conducted with various lots of such alfalfa seed to determine the parts of the United States in which the seed may be used with success. From the available data it is doubtful whether the seed from these regions is sufficiently hardy for the Northern States. A specialist of the bureau was sent to South America early in 1924 to study the alfalfa industry in Argentina. The results from field and greenhouse tests conducted in the United States are corroborated by data obtained personally in South America by this specialist as regards sections of the United States in which Argentine alfalfa may be safely grown. Work is being continued also in testing several new strains of alfalfa developed by the bureau.

Studies have been made of a mycorrhizal fungus which occurs abundantly in the roots of nearly all legumes as well as in many other plants. The fungus causes destruction of the smaller rootlets of the plants, especially those near the surface of the ground, at about the time the crop blossoms and is therefore probably an important factor in the early yellowing of alfalfa and other legumes. Its distribution seems to coincide with that of the plants which it attacks. The effect of soil temperature upon infestation of roots has been determined.

**Vetches.**—Through the activities of the bureau in testing various vetches in the Southern States a renewed interest has been awakened in the growing of vetch as a winter cover and green-manure crop. Woolly podded vetch is attracting wide attention, and it now appears that there will be sufficient demand for it to warrant the commercial production of seed in seed-producing sections. Purple vetch has shown conclusively its suitability as a green-manure crop in citrus orchards



in California and has also demonstrated its value in Oregon and other sections of the West. The growing of seed of this variety in the Willamette Valley is being encouraged.

**Cloverlike legumes.**—Of the considerable number of cloverlike legumes that have been tested, particularly in the South, to determine their value for forage and green manure, Korean lespedeza (*Lespedeza stipulacea*) has given the best results. This species has indicated its ability to volunteer as far north as northern Ohio, and it is thought that it will add materially to the forage resources of a considerable part of the Corn Belt. Approximately 500 pounds of seed of Korean lespedeza were distributed to specially selected farmers in the Corn Belt in the spring of 1924. Among the other cloverlike legumes with which experiments are being conducted and which are still giving promise are subterranean clover, serradella, and an improved strain of *Lespedeza striata*, Japan clover.

**Red-clover seed production.**—Red clover is par excellence the restorative crop for rotations in the Corn Belt. The steady decline of the red-clover acreage over a long period has adversely affected the yields of all other crops involved in the rotation. For at least 15 years the United States has been a heavy importer of red-clover seed. Most of this seed has come from Italy and southern France. Evidence is accumulating to show that much of this imported seed is not satisfactory for use in America. Cooperative trials which the department has been conducting with experiment stations in the Middle West have shown that the plants from imported seed are much more likely to winterkill than those from American seed, that they are more susceptible to certain diseases, and that they often give a smaller crop even when the stand is otherwise apparently satisfactory. As far as the investigations of this bureau have progressed, it has been found that Italian seed is everywhere unsatisfactory and that French and Chilean seed, while giving good yields in some parts, is unsatisfactory in Iowa, Minnesota, and elsewhere where the winters are severe. It is thought that if methods can be found by which small acreages of domestic red-clover seed can be conveniently harvested and hulled for home use, this will do more than any one thing toward solving the problem of red-clover failure in the United States. It is known that throughout the country, east of

the Allegheny Mountains at least, there are every year thousands of acres of good second-growth clover that are turned under instead of being harvested for seed, because in those neighborhoods no hullers are to be had and the farmer is not able to harvest and save the seed economically. If these farmers could save their own seed, the draft on the market stocks represented by their requirements would be materially decreased, and the seed produced in the States where it is grown commercially would be more nearly adequate to supply the demand.

#### GRASSES

**New grasses for the South.**—In the spring of 1924 approximately 625 pounds of Vasey grass (*Paspalum larrangayi*) seed were distributed. This grass, in the tests that have been made at McNeill, Miss., and other points, has proved of great value, particularly for Louisiana, Mississippi, and Florida. Efforts are now being made to encourage domestic seed production, so that an adequate supply will be available. Bahia grass (*P. notatum*) is still proving of promise for the Southeast, and it is hoped that the difficulty in obtaining commercial supplies of good seed of this grass will soon be overcome.

**Sudan grass.**—Reports from experiment-station workers as well as statements in farm papers all point to a continued increase in the acreage of Sudan grass. It is widely recommended as having the highest carrying capacity of any grass available for summer pasture in the temperate part of the United States. Feeding experiments in Kansas proved the hay to have a high feeding value for wintering both cattle and horses.

**Crested wheatgrass.**—Experiments with grasses adapted to the semiarid conditions prevailing in the Northwestern States have been in progress since 1908. Of all the grasses tested crested wheatgrass (*Agropyron cristatum*) seems to be the best. It is hardy, drought resistant, and easy to establish and is very palatable both as hay and pasture. Seed has been distributed to farmers by the bureau from field stations in North Dakota, South Dakota, Montana, Washington, and Oregon. Several farmers in Montana are now producing seed in quantity, and an increased acreage of this grass is likely to be seeded for pasture on account of its extremely early growth in the spring. It starts



growth before brome grass does, and the pasture and hay produced by it are very nutritious.

**Timothy.**—The tests of the Huron variety of timothy developed by the bureau at the timothy breeding station, North Ridgeville, Ohio, made by farmers have attracted sufficient attention to encourage seedsmen to commercialize the seed. This variety of timothy is characterized by its lateness and ability to remain green much longer after the seed is mature than ordinary timothy. It is probable that one or more large field-seed companies will buy all the seed that will be produced this year and place it with timothy-seed growers on a growing-contract basis.

#### DISTRIBUTION OF NEW AND RARE SEEDS

A distribution of new and rare field seeds was made throughout the entire United States, having for its object the dissemination of seed of new and rare crops, seed of improved strains of staple crops, and high-grade seed of crops new to sections where the data of the department indicate such crops to be of considerable promise.

During the fiscal year 1924 there were distributed 89,846 packages of new and rare forage-crop seeds, including Grimm alfalfa, Peruvian alfalfa, and Dakota and Kansas grown alfalfas; Great Northern field beans; Biloxi, Black Eyebrow, Hahto, Laredo, Manchu, Mandarin, Peking, Virginia, and Wilson-Five soybeans; Bush, Georgia, Early Arlington, and Tracy velvetbeans; Victor, Brabham, and Early Buff cowpeas; carpet grass, Merker grass, and Sudan grass; Siberian and Kursk millets; Bangalia, Chang, and Pedigree Green field peas; Dwarf feterita, Spur feterita, Black-hull kafir, Dwarf Yellow milo, and Sumac sorghum. In addition to distributing new varieties of soybeans for the North, the Laredo was distributed in large quantity in the Cotton Belt. This variety is virtually nematode resistant and has proved to be one of the best varieties that the department has distributed in the South.

Two new varieties of velvetbeans, the Tracy and Early Arlington, were distributed for the first time. These varieties require such a relatively short season for their maturity that they can be grown very successfully on the northern border of the Cotton Belt.

#### LOSSES FROM NEMATODES

Losses from the root-knot or gall nematode have been recognized for

a considerable period as a very heavy annual toll on most southern crops and many crops in the Southwest. During past years some progress has been made in practical control of this and other nemas through establishment of efficient rotation systems and through certain comparatively simple precautions to avoid prompt reinfestation of fields that have been practically cleaned. In addition, infestations of two different kinds of nematodes infesting alfalfa have appeared. One of these also infests clover, and apparently both are assuming serious proportions in the irrigated regions of the West. How soon satisfactory methods of control or eradication can be devised is problematical.

Perhaps the most striking development of the nematode investigations is the determination of the general parasitism of grasshoppers in certain areas by a group of nematodes which seems to be responsible for the scarcity of grasshoppers in these areas. Experiments are now under way upon the colonization of these parasitic nemas in areas where grasshoppers frequently appear in destructive abundance.

#### POISONOUS PLANTS IN PASTURES

The botanical survey of the areas in the southwestern United States where poisonous plants are prevalent was continued and a considerable portion of new territory covered. A portion of Virginia was also surveyed and information secured on the distribution of *Delphinium tricornis*, *Biscutella canadensis*, and *B. cucullaria*, which have caused loss through poisoning cattle and sheep.

The survey in New Mexico resulted in much new information regarding the poisonous plants of that section. Particular attention has been given to advising with forest rangers, supervisors, and stockmen in regard to simple methods of identification of poisonous plants of the range, thus enabling them to select areas free from these plants or those where the plants are least abundant. Eradication has been suggested and when practiced has resulted in a material saving in livestock.

#### COTTON

##### IMPROVED CULTURAL METHODS

**Later planting.**—Closer spacing protects cotton from the tendency to rank growth and late maturity which renders late planting precarious where wide spacing is used. Experiments are being continued to determine when

cotton could be planted to the best advantage in communities where farmers would agree not to begin planting before a specified date, in order to preserve their stocks of pure seed and avoid injury by the boll weevil. Since adequate reserves of pure seed are seldom available for replanting, the effort to plant cotton as early as possible often results in a serious loss of the best seed stocks. Many early plantings are less productive on account of poor stands and the stunting of the seedlings from unfavorable conditions or disease.

Though exceptionally high yields may be obtained from early plantings that encounter favorable conditions, later plantings have yielded more than the first planting in many experiments, so that the average or probable result should be considered rather than the occasional possibility. Planting too early not only invites injury by overwintered weevils but allows the weevils to breed earlier than they otherwise would. A planting of May 12, 1923, at San Antonio, Tex., was late enough to escape injury from overwintered weevils and yielded at a higher rate than most of the earlier plantings in the same series of experiments, including those that had been partially protected from weevils by the use of poison.

**Less chopping.**—The advantages of closer spacing of cotton plants in the rows are being more generally recognized, and experiments show that it is possible under some conditions to omit the thinning operation. The labor of chopping is thus saved, while the yields are not reduced but are often increased. In experiments conducted for three years at Greenville, Tex., equal or greater yields have been obtained from cotton that was not chopped or given only a little chopping at the bunchy places to bring the rows to the condition of an ordinary "open stand," with the plants averaging 2 to 4 inches apart. Chopping is considered necessary in some districts to facilitate weeding, but the weed problem is less serious if the cotton is not planted too early. The early plantings are often stunted by cold weather, while the weeds and grasses are able to grow.

**Community production.**—The investigations of cotton breeding have opened the way to a general improvement of the system of production by holding to a single superior variety in each community. The advantages of community production are being recog-

nized as of the same nature as other public improvements that require community action, as in the formation of irrigation or drainage districts, road districts, or school districts. Restriction to one variety improves the conditions of production in the community quite as definitely as irrigation or drainage of the land. With pure seed available for planting, larger crops of better quality can be grown, so that both the lint and the seed can be sold at higher prices. The right of communities to secure such advantages is recognized in an ordinance passed unanimously by the Board of Supervisors of Riverside County, Calif., January 28, 1924, making it unlawful to bring in or to have possession of other varieties of a plant after a pure-seed district has been constituted by a majority of the growers of a crop in any township or townships forming themselves into an association under the laws of the State of California "for the purpose of growing, producing, and marketing pure seed of such crop for propagating purposes."

#### GROWTH DISORDERS

Growth disorders constitute a special class of plant maladies not showing localized injuries, like fungous or bacterial diseases, but affecting the processes of growth so that the plants may not reach a normal maturity or produce a crop. Some at least of these growth disorders must be included with those known as virus diseases because of their infectious character, although the infective agent may not yet have been isolated or even definitely identified. These have been studied in other groups of plants. An abnormal behavior of cotton, accompanied by a general shedding of the buds and young bolls, has been observed for several years in the Salt River Valley in Arizona and is now recognized as a growth disorder under the name "crazy top," or "acromania," on account of its prominent symptom, the abnormal branching of the upper part of the plant. At first the crazy top was supposed to be a peculiarity of Pima, but it appeared in many fields of Upland cotton in the season of 1923. The symptoms of crazy top are more severe in Upland cotton than in Pima. A serious dwarfing and distortion of the leaves and other organs may occur, as well as an abortion of all the floral buds, so that the affected plants are completely sterile. The disorder may ap-



pear in scattered individual plants, or larger groups or areas may be affected. Serious damage is done in some fields.

#### ROOT-ROT

Root-rot, a disease caused by the fungus *Ozonium omnivorum*, is becoming more and more serious in the valleys of the Salt and Gila Rivers in Arizona, where, owing to the extension of the cotton industry in recent years, it is found to be more widespread than was formerly thought when alfalfa was the principal crop.

In alfalfa fields it is the habit of the disease to spread radially and to form almost perfect circles, the more recent activity being defined by the ring of recently wilted plants on the circumference. The behavior of root-rot in alfalfa fields may thus be said to resemble that of fungus fairy rings in their manner of spreading radially, areas becoming free from the disease after the active mycelium has passed, and also in the formation of fruiting bodies about the ring of most recent activity.

Diseased areas in alfalfa fields become occupied by various kinds of weeds and alfalfa plants which have recovered by sending out adventitious roots from fragments of old taproots that have remained alive just beneath the crown. In some seasons many of the larger spots show no renewed infection, but in the case of most of the smaller spots the diseased area of one year seems to be merely an extension of the area of the previous season. The rate of enlargement of regular circles in an alfalfa field was about 8 meters (26.24 feet) increase of diameter per year. In cotton fields regular circles increased in diameter about 9 meters (29.52 feet) in 50 days.

In Arizona the fruiting form provides an easy means of establishing the identity of root-rot activity. The chief requisites for fructification of the fungus appear to be a heavy type of soil, a dense cover crop, humid weather, and intermittent rainfall. In most of the fields examined the quantity of humus and organic carbon per surface foot of soil was less inside the root-rot areas than in adjacent areas not infected. Controlling the disease by promptly providing barriers for segregating new centers of infection and saturating the soil around them with formaldehyde solution was tried and found effective, but methods of control suitable for general field use have not yet been devised.

#### BREEDING EGYPTIAN COTTON

Cooperation has been continued with the associated cotton growers of the Salt River Reclamation Project and with the University of Arizona in maintaining a supply of pure planting seed of the Pima variety of American Egyptian cotton. Remarkably few off-type plants were found last summer in roguing the seed-increase fields, this fact indicating that the purity of the variety is being maintained satisfactorily under conditions of commercial production.

A smooth-seeded strain of Pima cotton has been developed, of which 15 acres were planted in 1924 at Sacaton, Ariz., and Bard, Calif., to provide sufficient seed for thorough field trials. Tests in comparison with the commercial stock of the variety, the seed of which is rather fuzzy, indicated that the smooth-seeded cotton can be ginned on the roller gin twice as rapidly as ordinary Pima, a difference which should greatly reduce the cost of ginning. The smooth-seeded strain also has a considerably higher lint percentage. The new strain, in comparison with the present commercial stock, is being subjected to yield tests and to spinning tests of the fiber, the latter in cooperation with the Bureau of Agricultural Economics, in order to determine whether it can be substituted advantageously for the stock now grown commercially in Arizona.

The investigations of selective fertilization in cotton and of the inheritance of the petal spot in the Pima variety have been concluded. Evidence has been obtained that smooth-seededness, like the presence of the petal spot, is a simple Mendelian character. Hybrids between the Pima and Sakellaridis varieties of Egyptian cotton, the latter being the most valuable variety grown in Egypt, have been carried to the fifth generation and have shown not only a desirable combination of the best qualities of both parents but a high degree of fixity and uniformity. Breaking-strength tests of the fiber conducted by the Bureau of Agricultural Economics have shown that the somewhat greater strength of the Sakellaridis fiber is fully expressed in some of these hybrids.

#### VARIETIES OF UPLAND COTTON

**Acala.**—A new type of Upland cotton, Acala, first discovered by the bureau in southern Mexico in 1906 and brought into commercial cultivation in 1916, is now very widely and favorably known. The plants are very early and produc-



tive, with large bolls and abundant fiber of a length and quality that usually can be sold at a premium ranging from 2 to 4 cents a pound above the price of ordinary short staples. In the Coachella Valley and several other districts in California the Acala cotton is now being planted exclusively, so that supplies of pure seed can be maintained, though much of the commercial seed in Texas and Oklahoma is no longer representative of the variety. The normal increase of good seed stocks is often prevented by unfavorable seasons that impair the quality of the seed or by the reserves of good seed being insufficient to meet the needs of replanting.

**Kekchi.**—An early-maturing productive type of Upland cotton discovered in 1902 in eastern Guatemala among the Kekchi Indians, known as the Kekchi variety, was found to have several weevil-resisting characters. The first plantings in Texas were very abnormal and some were completely sterile, but the normal habits of earliness and productiveness reappeared after several years of acclimatization and breeding. Selection has been continued for the development of uniform strains, and repeated tests have been made in comparison with standard varieties. In several cases the Kekchi cotton has outyielded all of the varieties, the fiber being also of better quality. It has been observed repeatedly that the Kekchi cotton is able to continue flowering and fruiting after the other varieties have ceased on account of weevil attack. Seed has not been distributed, but the variety is being grown on a commercial scale by a local association of farmers, and arrangements for the separate ginning of the seed are being made.

Vigorous and hardy seedlings are important, especially under such unfavorable weather conditions as in the spring of 1924. In northern Texas much of the cotton either had to be planted two or three times or the plants were stunted by long periods of cold or windy weather. Under such conditions it was observed at Greenville, Tex., that seedlings of Kekchi cotton suffered less damage and had grown to notably larger size before warm weather came. A reason for such behavior was found in the fact that the Kekchi seedlings have larger cotyledons, or seed leaves, which have a firmer texture and are less susceptible to injury than the first of the true leaves. Thus the size of the cotyledons or other seedling characters may be important in deter-

mining the values of varieties and in the selection and breeding of improved strains.

#### PHYSIOLOGY OF ALKALI AND DROUGHT RESISTANCE OF EGYPTIAN AND UPLAND COTTONS

The tissue fluids of various crop plants have been the subject of continued investigation, the object being to determine the relation between the properties of the tissue fluids and the resistance to alkali and drought, with a view to working out a method for the rapid selection of crop plants best adapted to conditions of limited moisture supply and high salt content of the soil.

The osmotic concentration, conductivity, and hydrogen-ion content of the leaf sap of Egyptian and Upland cottons grown under irrigation in Arizona have been investigated. Experiments have been undertaken to determine the chloride content of the leaves of these types of cotton and the tissue fluid properties of native indicator plants in Utah. Determinations have been made of the sulphate content of the leaves of Egyptian and Upland cottons as well as the physical and chemical properties of the tissue fluids of wheat, oats, and barley grown both with and without irrigation in Utah.

It has been demonstrated that the Egyptian and Upland types of cotton are sharply differentiated in respect to the properties of their tissue fluids, the differences being of a nature indicating that Egyptian cotton is somewhat better adapted to alkali soils than Upland cotton. The most remarkable result so far obtained in these investigations is the proof that when Egyptian and Upland plants are growing side by side under identical soil conditions the former absorb relatively more chlorides and relatively less sulphates than the latter. This fact points to a rather profound physiological difference between the two types of cotton and suggests that in considering their relative adaptability to alkali soils the character as well as the quantity of salts present should be taken into account.

Preliminary studies of first and second generation hybrids between Egyptian and Upland cottons have given indications that the above-mentioned physiological differences are inherited in a definite manner.

#### HEMP, FLAX, AND HARD FIBERS

##### HEMP

The selection of hemp, begun in 1902 and carried on more intensively since

1913, has been continued, although owing to a poor market for the fiber there has been little interest in hemp growing since 1920. Continued improvement has been made in the pedigreed selections which are grown at Arlington Experiment Farm. Two of these selections in 1923 averaged more than 5 meters (16.4 feet) in height and five others more than 4 meters (13.1 feet). Seed production has been included as a factor in selection in recent years, and it is gratifying to note that there is an increased yield of seed without any shortening of the internodes.

An improvement in the market for hemp fiber, beginning early in the spring of 1924, has resulted in an increased acreage of hemp in Wisconsin and Illinois and a consequent demand for seed from the hemp-seed growers, who in turn have taken practically all of the pedigreed seed available.

#### FIBER FLAX

Further improvement has been made in the pedigreed strains of fiber flax at the field station at East Lansing, Mich. The Saginaw variety, which has been developed by continuous selection since 1909, is now grown commercially on an area of more than 100 acres in Michigan and Oregon.

The pasmo disease, caused by the fungus *Phlyctaena linicola*, attacked the increase plat of Saginaw flax at East Lansing just before harvest time in July, 1923, and spread very rapidly. Seed was saved from a few apparently resistant plants that remained healthy in the worst infested areas, to determine whether a resistant strain may be developed. The remaining plants in the increase plat were destroyed in the hope of stamping out this disease, which appears to be the most dangerous and destructive of any that has attacked fiber flax in this country. No seed was distributed from any fiber flax grown at East Lansing in 1923, and all growers of fiber flax have been warned to watch for the disease and prevent it from becoming established in this country.

#### HARD-FIBER SITUATION

The imports of abaca, henequen, sisal, and ixtle fibers into the United States during 1923 aggregated 195,586 tons, valued at \$24,855,751. The supply of these fibers available during the past year has been adequate to meet the requirements of American manufacturers; satisfactory standards of quality in general have been main-

tained; and prices, without being unduly high, have been such as to yield reasonable profits to the producers of abaca, henequen, sisal, and maguey fibers.

The production of henequen fiber in Yucatan, which is now about 600,000 bales per annum, is not sufficient to meet the world demand for this fiber, and the old stocks are now entirely exhausted. The most important substitute for henequen fiber in the binder-twine industry is abaca.

During the early months of 1924 the production of abaca fiber continued above normal; in the month of May, 1924, it dropped to 9,088 bales below the production for May, 1923; and there are indications that the total production for 1924 will be less than the production of last year. Unfavorable factors in the abaca situation are a shortage of labor in the abaca provinces, the substitution of coconuts for abaca on many of the plantations in the Philippine Islands, and the destruction of fairly large areas of abaca by disease.

For a number of years this bureau has worked in cooperation with the Philippine Bureau of Agriculture to encourage the development and improvement of the fiber industries of the Philippine Islands. As these islands now constitute our main source of supply of hard fibers and as the Philippine methods of fiber production are in many respects still in a crude and primitive condition, the islands offer a rich field for work of this character. The production of maguey and sisal in the Philippines is now equivalent to more than one-third the total production of henequen fiber in Yucatan.

#### DRUG, OIL, AND ORNAMENTAL PLANTS

##### DRUG PLANTS

**Flowers for insect powder.**—The demand for insect-powder flowers (*Pyrethrum cinerariaefolium*) and the high price asked for them by foreign producers led to preliminary plantings in several localities. The first returns from the experimental plantings indicate that under proper cultural methods a good yield may be expected. The potency of the flowers grown domestically is being studied. Factors, such as drying and storing, which affect the quality and insecticidal value, and the question of suitable machinery for handling the crop on a farm scale are receiving attention.

**Menthol.**—The quantity of menthol consumed in this country is relatively



large, the yearly value often exceeding \$1,000,000. Recently manufacturers using this chemical have become interested in its domestic production. This bureau has undertaken a study of the plant (*Mentha arvensis*) which is the source of menthol, with gratifying preliminary results. Cultural experiments were conducted at Florence, S. C., Greensboro, N. C., Arlington, Va., Seneca Falls, N. Y., South Bend, Ind., and Junction City, Oreg. The results of these experiments indicate that the mint grown in the South, especially at a low elevation, yields an oil containing less menthol than does the plant grown in the more northern localities. When grown in the North the acre yield of oil was found to be comparable to that of American mint (*M. piperita*) and to contain a high percentage of menthol. The general results were satisfactory, and increased plantings have resulted in localities considered most favorable.

#### OIL PLANTS

**Cedar oil from waste.**—The study of the utilization of cigar-box cedar (*Cedrela odorata*) has been completed and a satisfactory method devised whereby the oil distilled from this waste can be used to impart the cedar aroma to containers made of cheaper materials. A rather comprehensive survey of the cigar-manufacturing industry indicates that all the oil obtained from the waste can be utilized in the containers made from inodorous wood or other materials. The cost of obtaining the oil is relatively small, and the refuse can be utilized, as it is at present, by burning.

**American saffron.**—The experimental culture of American saffron (*Carthamus tinctorius*) was extended to a field basis in South Dakota. The results obtained thus far indicate that the plant can be readily grown and that the return per acre in fixed oil is comparable to that of flax. The drying qualities of this oil recommend it to paint and varnish manufacturers.

**Tung oil.**—The Chinese tung-oil tree, to which attention was first devoted by the bureau 20 years ago, is attracting much interest in the South Atlantic and Gulf States. The increasing use of tung oil in the paint, varnish, linoleum, and other industries and the uncertainty of the supply from China caused American manufacturers to consider seriously the possibility of developing commercial plantations in this country. The imports of tung oil

for 1923 exceeded 90,000,000 pounds, with an import value of about \$13,000,000. This is approximately the quantity estimated as available for export from China. The bureau is assisting the other agencies now engaged in this experimental work by supplying information, especially concerning sources of supply of American-grown seed.

**Chaulmoogra oil.**—The successful use of chaulmoogra oil in the treatment of leprosy and the desirability of developing a source of supply in the Western Hemisphere have impelled the bureau to continue the work of establishing in tropical America the several species which yield this product. During the year under consideration several thousand trees of two chaulmoogra-yielding species were distributed. One of these, *Taraktogenos kurzii*, is the official source of this drug; the other, *Oncoba echinata*, is a West African shrub whose seeds are known to contain chaulmoogric acid, but which has not yet been exploited commercially. Arrangements have been made to establish a 10-acre plantation of *Taraktogenos* in the Canal Zone, a 5-acre planting in Porto Rico, and smaller ones in Cuba, Brazil, Costa Rica, and other tropical American countries. *Hydnocarpus wightiana*, another source of chaulmoogric acid, has come into bearing at Balboa, Canal Zone, plants having been sent there three years ago by the department.

#### ORNAMENTAL PLANTS

**Chrysanthemums.**—In the study of hardy chrysanthemums, 14,000 plants were grown from seed collected from older varieties. From the older varieties 3 were selected as worthy of future consideration and 120 individuals out of the 14,000 seedlings were saved for further study. Seed from these 123 individuals was saved and is being grown the current season with a view to comparing the seedlings with selections made in previous years. The earliest flowering individual of the 120 selections made began to bloom in July and was in flower continuously until freezing weather.

**Roses.**—The rose-breeding work has been continued and many new seedlings have resulted from crosses made in 1923. A considerable number of seedling roses which resulted from Doctor Van Fleet's work are under preliminary test at several representative rose-testing gardens. The stock of the Mary Wallace rose which had been developed has been put in the hands



of the American Rose Society for further propagation and distribution under a plan which it is believed will insure the effective commercial introduction and prompt availability to the public of this variety at reasonable prices without expense to the department. Some 35 standard varieties of tea and hybrid tea roses have been propagated on their own roots, preparatory to inaugurating the variety tests on a better basis than heretofore. Stocks have been secured so that the same varieties may be grafted on three different roots. This will provide a means for studying the varieties when grown on their own roots and on certain stocks.

**Bulbs.**—Most of the investigational work in bulb culture is conducted at the plant introduction gardens at Bellingham, Wash., and Chico, Calif., and at Arlington Experiment Farm. However, the sources from which information is being obtained are rather numerous and widely distributed. This is due to the prevailing policy of placing material with responsible parties who are interested in bulb culture from a commercial standpoint and who are growing the material received from the department under the general direction and advice of its representatives. From such activities and results a good deal of information of great value is being obtained.

For the purpose of determining the forcing quality of American-grown bulbs, material was brought together from more than 50 different growers, this representing fully 150 distinct entries. In general, the results of the forcing tests were very favorable to American-grown bulbs in comparison with the results obtained from bulbs representing the stocks generally used for forcing purposes.

More than 1,500,000 lily seeds were placed with growers, the Easter lily being the principal representative. Great interest in an Easter-lily industry based entirely on American-grown bulbs is developing, and it is stimulated greatly by the practicality of propagation from seed.

## SEED INVESTIGATIONS

### TESTING SAMPLES

During the fiscal year 1924 the seed-testing laboratories received and examined 23,374 samples of seeds. Of these, 12,376 came to the Washington laboratory and 10,998 to the four branch seed-testing laboratories maintained in cooperation with State institutions. These samples represent both

vegetable and field seeds from farmers, seed dealers, and investigators, to whom reports of analyses were sent, showing the presence of weed seeds and worthless material or germination, or both, as requested. Through this service the work of the laboratories is immediately applied to practical agriculture. Five hundred and fifteen samples of vegetable seeds were purchased and tested in the laboratories for vitality and also grown in the field to ascertain their trueness to name.

As in previous years, opportunity has been extended to representatives of seed houses or agricultural experiment stations to become familiar with the laboratory methods and practices of seed testing during the months of July and August. These summer courses in seed testing have helped to standardize methods among experiment-station workers and seed dealers.

### ENFORCEMENT OF THE SEED IMPORTATION ACT

The enforcement of the seed importation act involved the testing for mechanical purity and germination of 2,900 samples of forage-plant seeds subject to the seed importation act offered for import into the United States. In addition, 669 samples of seeds not subject to the act were received and examined. The total importations of seed in 1924 were the greatest of any year since the passage of the act in 1912. Approximately one-third of this was red clover.

The general quality, so far as purity and germination are concerned, of imported seed subject to the seed importation act has been good.

### SEED VITALITY

A preliminary report of investigations on the uncertain germination of cottonseed grown in Texas and the surrounding region is in press. The study of this problem is being continued both in the laboratory and in the field.

A study of the physiology of dormancy and of germination of seeds has been continued and prosecuted from several angles. The changes in freshly harvested wheat, the bearing of the histology and microchemistry of bluegrass seeds on their germination requirements, and the relation of oxygen and enzymes to afterripening of dormant seeds have all been given particular attention. The solution of these problems will have an influence on both crop production and methods of seed testing.

### ADULTERATED SEEDS

During the spring of 1924 Kentucky bluegrass seed was collected and examined for adulteration. Few lots appeared to be either adulterated or misbranded.

Samples of Sudan-grass seed and crimson-clover seed were collected and tested for germination and the results published as press notices. The general quality of Sudan-grass seed and crimson-clover seed offered was good.

The examination of crop seeds grown in different localities of the United States and foreign countries, with special reference to the occurrence of incidental seeds as a means of determining the place where the seeds were grown, has been continued.

The dissemination of the results of studies of the species of *Agrostis* relative to the distinguishing characters which make accurate determination possible has had a wholesome effect on the quality of imported bentgrass seed.

### FOREST DISEASES

#### WHITE-PINE BLISTER RUST

During the past year the bureau has vigorously prosecuted its cooperative programs for the suppression and control of the white-pine blister rust. The establishment and rapid spread of this fungous disease threatens three of our most valuable forest species having an estimated standing-timber value of approximately \$550,000,000. Even more important from the standpoint of conservation and future forest resources are the immature stands of these species, which are readily destroyed by the rust when it becomes established on areas where wild *Ribes* (currant and gooseberry bushes) are numerous.

**Control in the East.**—The blister rust has been present in some of the white-pine forests of the Northeastern States since about 1900. Effective control by systematically eradicating *Ribes*, the alternate host plants, growing within and near pine stands has been worked out and well demonstrated. A definite program (estimated to be completed in eight years) was begun in 1922 for promptly accomplishing the systematic eradication of *Ribes* on pinelands throughout the infested States, in order to prevent serious losses to maturing stands and assure stability in the continued production of the white-pine crop. This program is being

prosecuted jointly by the bureau and the responsible State agencies. The bureau places a trained agent in each important white-pine county or district to give the necessary expert advice and leadership in control work; the State provides funds and personnel for supervising the eradication of *Ribes*; and towns, associations, and individual landowners furnish labor for actually locating and destroying the bushes.

**Occurrence in the West.**—Blister rust was discovered in British Columbia in the fall of 1921. It was evidently introduced from France in 1910 on young white pines which were planted near Vancouver. Field conditions favored its rapid spread, and now it is thoroughly established on western white pine in the coastal region of British Columbia. From these centers of heavy infection the rust is spreading to the east and south. In 1923 its advance spread on cultivated black currants reached points in eastern British Columbia and Washington within 35 or 40 miles of the western white-pine forests of the Inland Empire. This rapid and unavoidable eastward spread of the disease is an immediate menace to the valuable western white-pine forests located in northeastern Washington, northern Idaho, and northwestern Montana. The extension of the disease to the south has been somewhat slower than the spread north and east, but its primary spread on cultivated black currants has already extended along the coast of Washington to the Columbia River. Its extension in this direction is a direct menace to the sugar-pine forests of Oregon and California.

The stand of western white pine aggregates 22,000,000,000 board feet, valued at \$110,000,000, and that of sugar pine 38,500,000,000 board feet, worth \$154,000,000. Every thousand board feet of lumber of western white pine that is cut leaves an average of \$13 to \$16 in pay rolls in the community. Based on the 1920 production, this ranges from \$4,360,000 to \$5,365,000 in the Inland Empire region.

**Control methods for the West.**—Work was begun in 1922 to devise methods for the control of blister rust under western conditions. By 1923 it had been determined that no natural barrier to the spread of the disease exists from the coast region of British Columbia to the stands of western white pine in the interior; that western white pine is extremely susceptible to damage by blister rust; that the cultivated Eng-



lish black currant is the species most susceptible to infection; and that, furthermore, this currant is almost invariably responsible for the introduction of the disease into the drier localities to the east and south; that is, in the direction of the commercial stands of western white pine in the Inland Empire and of sugar pine in southern Oregon and California. This showed that the most effective method to delay the spread of the disease, in order to gain time for applying actual control measures in commercial stands, would be the removal of the cultivated black currant from the five-needle pine regions.

Lately it has been determined that no natural barrier exists, nor does the creation of an artificial barrier seem possible, to the spread of the rust to the sugar-pine region. The outstanding accomplishment of this year, however, was the collection of strong circumstantial evidence that the disease can spread 110 miles and probably much farther directly from pines to currants and gooseberries, but that this long-distance spread has practically been confined to the cultivated black currant. This means that the eradication of the cultivated black currant should be pushed as rapidly as possible in order to prevent rapid introduction of the rust into the Idaho white-pine region.

In cooperation with the Western States the campaign to eliminate the cultivated black currant throughout the pine-growing region has been vigorously prosecuted. This work has progressed to a point where it will be completed next year in western Montana, Idaho, Washington, and Oregon. Rigid enforcement of the blister-rust quarantines against infested regions has been successfully maintained. These activities are designed to delay the spread of the disease in order to minimize the damage while adequate local control measures are being worked out and applied.

The control problem in the West is new and increasingly important because of the peculiar economic importance of the western white and sugar pines in profitable timber operations. Much of our national lumber supply is harvested in the western white-pine belt. A large portion of this lumber comes from low-grade species that in many sections can not be handled profitably alone and which contribute to our supply only when harvested in conjunction with western white-pine operations. Because of its high market value the western white pine often

pays for the entire lumbering operation on forest areas and yields good profits besides.

#### DOUGLAS FIR LOSSES

**Decay.**—The stand of Douglas fir in Oregon and Washington is estimated at more than 500,000,000,000 board feet, or nearly one-fourth of all the saw timber remaining in the United States. Unfortunately, this species is subject to heavy loss through decay, in some localities so great that it is almost impossible to log at a profit. Throughout the Douglas-fir region the average loss is estimated to range from 15 to 20 per cent. By using 15 per cent as the average cull percentage in the entire stand, it is seen that the present loss from decay is about 75,000,000,000 board feet, which at a stumpage value of \$1.50 per thousand board feet would amount to \$112,500,000.

This loss is so severe, both directly in the actual loss in timber and indirectly in the increased overhead charges due to handling defective material and gross errors in estimating stands, that the lumber industry of the region has strongly demanded an intensive investigation into all phases of the problem. Consequently, the study now under way has two main objects, to determine (1) how the direct and indirect losses due to decay in the present commercial stands can be prevented or reduced and (2) how losses from decay can be controlled in future commercial stands.

Thus far it has been found that a type of decay caused by one fungus is responsible for most of the cull in Douglas fir and that the presence and extent of this decay in the living tree or in felled timber is revealed by certain definite indications on the outside of the trunk. This fact is of paramount importance. There has been and still is much confusion and misinformation among foresters and lumbermen in regard to the detection of decay in living trees. On logging operations this has resulted in considerable financial loss either by cutting totally decayed trees or by leaving sound trees standing because they are supposed to be decayed. In addition, gross errors in estimating standing timber have been common, with the consequent heavy loss to the seller or purchaser and often with attendant costly litigation.

But the most important phase of the problem is not yet solved. It must be determined at what age in



the life of the stand trees become subject to extensive decay in order that stands of the future may be cut before this time is reached and thus eliminate the present very heavy loss. Highly important also is the periodic rate of increase in the loss through decay after the above-described age has been passed. Such information is of the greatest value to owners of extensive stands of mature or overmature timber, enabling them to estimate the loss in their holdings and adapt their plans accordingly.

These questions are being answered by a study of all the felled trees on a wide range of plats in stands of different ages and conditions throughout the Douglas-fir region of Oregon and Washington. Up to December 31, 1922, the study of 20 plats containing 2,016 trees had been completed.

**Canker.**—Since the war a vigorous movement for reforestation has started in Great Britain. Perhaps the most prominent species planted there is the American Douglas fir. In the last few years this has become subject in an increasing degree to a destructive canker caused by the fungus *Phomopsis pseudotsugae*. The origin of the disease is so far a mystery. We are much concerned in keeping it out of the United States. Unfortunately, before the enactment of Quarantine 37 at least 50,000 trees of various nursery-stock sizes, potential hosts of the canker, were imported into the United States from Great Britain. These shipments are being followed up, and others traced through the customhouses. So far the disease itself has not been recognized in America. Studies of its life history and behavior are in progress. Because the Douglas fir constitutes so large a proportion of our remaining saw timber, this disease out-classes any tree disease yet imported in its potentialities of damage.

#### CHESTNUT BLIGHT

The chestnut stand in America is now almost completely infected with chestnut blight, and three-quarters of it is dead. Investigations now in progress will show by January, 1926, how many years it will take to kill the remaining chestnuts. Some resistant American chestnuts have been found, and immune ones probably exist. An intensive survey should be made to locate such trees in order to establish a future supply of tanning material.

#### DETERIORATION

**Windthrown timber.**—On January 29, 1921, a hurricane swept the west coast of Washington and extended inward for about 100 miles. About 6,289,500,000 board feet of western hemlock, silver fir, Sitka spruce, western red cedar, and Douglas fir was blown down. At \$1.50 per thousand board feet, the value of this timber is \$9,434,250. Obviously the rate of deterioration of this timber is of great importance in relation to the possibility of salvage. No exact figures on this problem are to be found.

Observations during 1921 and 1922 showed little deterioration in timber of merchantable size except for slight degrade in the sapwood due to stain and borers. The same condition held during 1923. Decay has as yet caused no loss.

These facts are directly contrary to preconceived ideas, since most authorities believed that deterioration would be heavy in all species except Douglas fir within three years. This timber will have a salvage value for a longer period than was generally supposed.

The study will not be finished until the timber has completely deteriorated. The results will be very valuable for the future, because windfalls of greater or lesser magnitude can be expected in this region from time to time if past occurrences are a criterion.

**White oak for fence posts.**—To determine the durability of certain western oaks when used as fence posts, compared with the so-called durable-wood species, such as cedar and juniper, thousands of old fence posts at altitudes ranging from 5,000 to 8,500 feet were examined. It was found that sound white-oak posts, especially the Gambel oak, when set in the ground green and unpeeled last from 25 to 40 years. This discovery makes possible the use of a new species of wood for posts, since oaks were heretofore generally considered worthless for such purposes. Gambel oak in the southwestern United States is found at altitudes of 5,000 to 9,000 feet and of a size that is just right for fence posts, and its range is in the region where many of the large ranches and farms are located. The use of this wood will save thousands of dollars annually to farmers and stockmen, since these posts can usually be found right at hand, are easily cut, and do not have to be hauled far.

Gambel oak heretofore has been considered practically worthless except for firewood.

### RUBBER PLANTS

**Expedition to the Amazon Valley.**—An expedition was sent to the Amazon Valley to obtain more definite data for comparing the conditions of production and methods of extraction applied to the wild trees with those of the East Indian plantations. The actual yields of latex were noted for large numbers of trees. Observations also covered a count of the number of cuts used in tapping the trees and measurements showing their circumference, the thickness of the bark, and the number of rings of latex vessels. In these and other respects a very wide range of variation was shown among the wild trees, even in the same localities. The native methods of extracting the rubber are not only very injurious to the trees, but their general destructive effect is shown by the complete abandonment of many former regions of production which were more accessible than the regions now being exploited. Trees of special quality were located in the Acre district of Bolivia, where propagating material was obtained and taken to the Canal Zone. Also the diseases of the rubber tree were studied and material collected in many localities. The leaf disease that has proved injurious in Guiana was found to be widely distributed in Brazil, but apparently has not interfered to the same extent with the small plantations that have been established in a few localities.

**Experiments in the Southwest.**—Several plants that are natives of dry regions in western Texas, Arizona, and California are known to contain rubber or related substances of value in rubber manufacture as compounding ingredients. These are being investigated. The well-known guayule shrub (*Parthenium argentatum*) of northern Mexico also grows wild in western Texas and is known to be capable of cultivation in Arizona and southern California. One of the desert milkweeds (*Asclepias subulata*) which contains rubber is also proving to be well adapted to cultivation in the lower Colorado Valley near Yuma. The plants are perennials, grow rapidly during most of the year if supplied with water, and form large clusters of straight upright stems that can be cut and harvested readily. These are soon replaced by new growth. The seedlings also grow

rapidly and begin to flower and fruit within a few months. Root sprouts are formed on irrigated second-year plants, so that vegetative propagation from root cuttings may be practicable. Other rubber-producing species of *Euphorbia*, *Pedilanthus*, and *Cryptostegia*, secured from the neighboring dry regions of western Mexico, are included in the experiments in southern California.

**Production possibilities in southern Florida.**—Considering the existence of large areas of unused lands in southern Florida, the need of a careful determination of the behavior of the different types of rubber plants and of the rubber-producing possibilities of this region is apparent. Although there is no prospect that the East Indian plantation system of rubber production can be established in Florida, other systems and methods may be found practicable, either as separate cultures or in combination with other lines of tropical production. It is known that many of the tropical rubber-producing species can be grown under Florida conditions, but specially adapted varieties and specially devised methods, both of growing the crop and of extracting the rubber, are likely to be required before any new system of production can be developed. That so many difficulties had to be surmounted in establishing the culture of Hevea shows that equally careful study of other systems is needed to determine their practicability.

**A disease of rubber trees in South America.**—A special investigator of the diseases of the Hevea rubber tree visited Dutch Guiana, British Guiana, and the island of Trinidad in the summer of 1923 to verify reported injuries to Hevea plantations by a leaf disease. First-hand information was obtained showing that the planting of rubber in these regions has ceased and that the former plantations are largely abandoned on account of a fungous disease that attacks the young leaves and keeps most of the trees in a state of partial defoliation. Many of the trees die or remain stunted, though in some cases the disease apparently is outgrown and the adult trees remain healthy.

### PLANT NUTRITION

#### EFFECT OF LIGHT PERIODS

Continuing investigations on the effect of length of day on plant growth, it has been found that the distribution of the hours of illumination through the 24-hour period is of considerable



importance. Thus when exposed to sunlight for 14 hours on alternate days only (the equivalent of 7 hours of light daily) short-day plants show the usual response to a short day; that is, they are caused to flower. When, however, these plants are exposed each day to sunlight during the morning and afternoon but darkened from 10 a. m. to 3 p. m., they behave as though exposed to light for the whole day; that is, they do not flower. Moreover, by using artificial illumination it is found that two alternating periods of illumination of 6 hours each, or three periods of 4 hours each, markedly delay flowering of short-day plants as compared with a single daily illumination of 12 hours. Some long-day plants, on the other hand, tend to behave in the opposite matter.

Continuous illumination is harmful to many plants, chlorosis being a prominent result. While the extent of the injury is increased with increase in intensity of the illumination, in some cases marked injury results with an intensity of 3,000 foot-candles or less. With an intensity of 8,000 foot-candles all plants tested have shown decided injury and some have been killed. Where the intensity is not excessive maturity is hastened in some long-day plants, but this is not the case with short-day plants. Experiments with colored light have shown that the green plant is capable of completing its life cycle in the absence of any particular wave length of the visible spectrum. The life cycle also may be completed in the absence of ultraviolet or near infrared radiation. In tests under long-day and short-day conditions in which the total radiant energy per day remained constant, but with a comparatively wide range in intensity of illumination, no relation was found between the response of the plant and the intensity measured either in terms of light units or heat units, the formative effects on the plant being governed simply by the duration of the illumination.

#### SOIL BACTERIOLOGY

**Crop growth and soil bacteria.**—Experiments conducted for several years in the greenhouse and in the field have shown that the beneficial effect of legumes upon the succeeding crops is frequently much higher than it could be if only the plant food would have to be considered that becomes available by the decomposition of surface and root growths of the legumes. In

the field experiments, which are now in their tenth year, the crop increase caused by the preceding legume has been almost or quite as high where the legume was removed for hay as when it was plowed under for green manure. It was equal to that secured by the application of 200 pounds of nitrogen per acre in the form of ammonium sulphate or sodium nitrate. The nitrogen assimilated by the legumes from the air averaged 60 pounds per acre a year. In the greenhouse tests where a leguminous crop was immediately followed by a cereal crop increases up to 300 per cent have been obtained, although the surface growth of the leguminous plants and in some cases even the roots had been removed.

Bacteriological tests have shown thus far that there is a marked change in the microflora of the soil, especially under and after cowpeas. Certain bacteria that are able to fix the atmospheric nitrogen without symbiosis with higher plants were found in much larger number than under cereals, and the nitrification was regularly higher under and after legumes than under cereals, sometimes even higher than in fallow soil, which otherwise offers the most suitable conditions for nitrification. As a whole these experiments demonstrate clearly that very satisfactory crops can be obtained without the application of nitrogenous fertilizers if by practicing a suitable crop rotation full use is made of the nitrogen-fixing abilities of the root-nodule and other soil bacteria.

**Legume inoculation.**—During the past year approximately 37,000 cultures of legume bacteria, 40 per cent more than in the preceding year, have been distributed to farmers in various parts of the United States. Some cultures have been furnished to State institutions of the United States and to workers in foreign countries in addition to the general distribution. In the inspection of commercial legume bacteria cultures, the quality has been found to be higher this year than last, due largely to the recent disappearance from the market of a number of the poorer brands, but there has been no evidence that the inoculated fertilizers examined possess the qualities claimed for their bacterial population. This year 10 brands of commercial cultures and 4 brands of inoculated fertilizers have been examined or are now under test.

In investigations of legume bacteria and nodule formation it has been es-



tablished with navy-bean seed infected with the bean-wilt organism (*Bacterium flaccumfaciens*) that it is possible by the addition of a small quantity of moisture to stimulate the bean wilt to an appreciable extent under certain conditions. Although this effect suggests the possibility of detrimental results from the common process of applying pure cultures to navy-bean seed, it is indicated from data obtained at our various field stations that liquid inoculation on good seed will cause no such condition, and with infected seed in most cases the result is almost negligible.

#### EFFECT OF CROP ROTATIONS UPON TOBACCO

Results of fairly extensive cropping tests with tobacco, which have been in progress for several years, do not support the view which has been held by some that the tobacco crop is especially destructive of soil productivity, and apparently the system of cropping rather than the crop itself is mainly responsible where general exhaustion of the soil has resulted. On the other hand, tobacco shows striking peculiarities in its relation to other crops in the rotation system. In comparative tests on a sandy loam type of soil both summer and winter legumes grown as soiling crops have given large increases in yields of corn and moderate increases in the potato crop and also have markedly increased the yields of small grains following after corn and potatoes and after tobacco. As to the tobacco crop, while the first effect of the legumes has been to considerably increase the yield, in most cases this increase has not been maintained. The gain in value of the crop has been even less than the gain in yield. There are also notable differences in the effects of the several legumes on tobacco, red clover giving the best results and soybeans the poorest. Where no fertilizer has been applied, the use of legumes as soiling crops, with lime, has resulted in practically complete failure of the tobacco crop within a few years. Continued use of rye as a cover crop has resulted in a distinct downward trend in the yield of tobacco, much as in the case of legumes used as soiling crops.

Where the yield or the quality of the tobacco crop has declined, no system of crop rotation has been found which equals the old plan of resting the land for a period of years. Intensive methods, including the growing of soil-improving crops, may hasten rather than prevent decline in

the yield of tobacco. Obviously, decline in the yield of tobacco does not necessarily involve general soil exhaustion. In general, the yields of succeeding crops, especially the small grains, are better after tobacco than after corn and are more nearly comparable with the yields after potatoes in spite of the fact that the latter crop removes but small quantities of plant-food elements from the soil. In comparative tests, the yield of tobacco has been somewhat larger after corn than after tobacco itself, but potatoes have given poorest yields after corn and best yields after tobacco, with intermediate yields in continuous potato culture. Corn in continuous culture has given somewhat reduced yields as compared with production after tobacco and after potatoes. Differences in fertilizer treatment have changed the general level of crop yields, but have not changed the relative crop effects in these tests.

In connection with further studies on the frencing disease of tobacco, an investigation of soil aeration as affecting the tobacco plant has given results of considerable interest. Growth was markedly stimulated by aeration both in pot cultures and in water cultures, indicating that tobacco is quite sensitive to the oxygen supply of the soil. Moderate concentration of carbon dioxide in the soil was found to be beneficial. Studies in overwintering of the wild-fire disease have furnished evidence that dried or cured infected tobacco may be a source of seed-bed infection. In field tests during the past two years in southern Maryland ammonium phosphate as a fertilizer for tobacco has given unsatisfactory results, while urea as a source of nitrogen has given satisfactory yields and the quality of the cured tobacco has been good.

#### ORGANIC SOILS FOR TRUCK CROPS

During the several years plant-nutrition work has been in progress in the field and in the greenhouse it has been found that large areas of muck and peat soils located throughout many sections of the country are well adapted to the production of cabbage, onions, celery, lettuce, sweet corn, carrots, parsnips, beets, cauliflower, and other vegetable crops. In the field the limiting factors have been found to be drainage, aeration, and the supplying of potash or phosphate salts, and in some cases lime when it is desired to produce crops demanding neutral or alkaline conditions. With proper

management it has been found possible to grow heavy crops of most of the vegetables on the muck soils found in great areas throughout many parts of the country. In the greenhouse it has been found that muck and peat of certain characteristics are well suited to the growing of such forcing crops as lettuce, tomatoes, cauliflower, radishes, roses, and carnations. This material has been used as a substitute for manure with good results. It has been found to be very suitable for the starting of seeds and plants possessing the characteristics demanded of soils used for such purposes.

A large number of lettuce varieties were grown on organic soil areas in the work at South Bend, Ind., and at Williamson, N. Y., during 1923. The results showed that there are wide differences in the seed of the same variety as sent out by different seedsmen and that some of the strains are much better suited than others to muck-soil conditions. Considerable selection work has been done with lettuce and other crops with a view to developing strains or varieties that are particularly adapted to organic soil. The results with sweet corn on organic soil indicate that it can be grown on some of these soils at least in a very satisfactory manner for canning purposes.

It has been found that crop rotation is important and that the addition of commercial plant foods varying with different types of organic soil is necessary in order to maintain maximum crop-producing possibilities. The absolute necessity for the practice of a crop rotation that will keep the soil well supplied with decaying vegetable matter to prevent blowing and probably to promote bacterial action, the need for potash, the need for phosphorus on many muck soils, and the importance of using strains and varieties of vegetables adapted to muck soils are outstanding results thus far.

There are now in the bureau 546 profile records of peat lands, together with 705 samples of peat. These have been obtained from localities in 98 counties and represent peat areas in 11 States, viz, California, Florida, Indiana, Iowa, Massachusetts, Michigan, Minnesota, New Jersey, New York, Ohio, and Wisconsin. To these records is being added information concerning crop yields, the effects of water level and the mineral subsoil, and various methods of cultural and cropping practices, with a view to determining the relative value of peat lands to different lines of production.

## FERTILIZER MATERIALS

**Fertilizers lower in potash.**—Experiments on the effect of the lack of potash in causing potash hunger of such crops as potatoes, cotton, and tobacco made during the war and the fertilizer studies with potash materials and potash fertilizers made subsequently have shown on the one hand the extreme importance of potash in the production of healthy well-nourished plants and on the other hand that under normal conditions existing before the war farmers were using an excess of potash in fertilizers, especially on such crops as potatoes. Continued experimentation has shown these observations to be correct, and the decrease of potash in the fertilizer formulas throughout these regions where the bureau's experiments were conducted is now increasingly in evidence.

**Cyanamid.**—The use of cyanamid as the entire source of nitrogen has not proved satisfactory with a number of crops. This was shown to be due to several factors, notable among which was the transformation of the cyanamid in the fertilizers used to other nitrogen compounds which were either not available to the plant or which had a harmful action upon growth. These changes were principally influenced by the acid character of the phosphates commonly employed in fertilizers. It was observed, however, that when cyanamid was used with basic phosphate, corn especially gave increased crop yields. Accordingly, experiments were started, using various quantities of cyanamid with basic phosphate fertilizers and potash in growing corn on a number of soil types in Indiana, Pennsylvania, Maryland, Virginia, and South Carolina, in cooperation with the respective State experiment stations. These experiments indicate that under these conditions cyanamid compares very favorably with other nitrogen carriers, such as sodium nitrate and sulphate of ammonia.

**Concentrated fertilizers.**—The fixation of nitrogen from the air and other changes in industrial processes are bringing into the market a considerable number of new nitrogen materials which are usually high in nitrogen content. Many of these materials are being used in the fertilizer industry by being mixed in various proportions with other ingredients in the so-called commercial fertilizers. In this form most of them have been shown by experiments conducted on a number of crops and on different soil



types to be good sources of nitrogen, comparing favorably with the ordinary nitrogen compounds used in fertilizer practice. Some of them, on the other hand, have been shown by these experiments in greenhouse and field to be either poisonous to plants or to soil bacteria, and others have been shown to be of very doubtful economic value. The use of these high nitrogen-carrying materials together with improved methods in phosphoric-acid manufacture make possible the production of fertilizers in a more concentrated form; that is, fertilizers of much higher analysis than have formerly been manufactured and sold under the term commercial fertilizer. With the introduction of these more concentrated fertilizers come new problems of distribution and application under field conditions for different agricultural crops. As above mentioned, the individual concentrated chemicals have been tested and their availability for agricultural purposes shown. New experiments to determine their best use when the materials are used in their most concentrated form are being inaugurated.

**Chemical studies.**—The chemistry of humus has been further studied in the laboratories, and a number of interesting points are being demonstrated. Among these are the fact that organic matter is largely of a colloidal nature and that definite isolable constituents, such as nucleic acid, resins, resin acids, phlobaphenes, and gums are likewise colloidal in character. There has been isolated a substance of colloidal nature from a specific soil which is soluble in hot water but on cooling produces a jelly. This material is hydrolyzable by acids, producing a sugar compound. It is the first instance of a definite organic colloid of the jelly type being isolated from a soil.

It has also been shown that in the decay of organic matter in soils organic acids are generated and are in some instances responsible for soil acidity, and a number of free soil acids of organic character belonging to the fatty acid series have been isolated from field soils. While it is not contended that all acid-soil conditions are due to organic constituents, it is nevertheless clear that there are conditions under which free organic acids existing in soils are the cause of soil acidity. An organic constituent capable of dyeing wool and soil from shades of light yellow to dark brown has been separated from soils. This material is rather widely distributed and appears

to form a portion of the so-called humus or dark-colored constituents of soils. A study is also in progress dealing with the chemistry of humus bodies by attempting to synthesize them by starting from compounds of known chemical identities.

Under different fertilizer applications plants have been shown to have a decidedly different appearance as to chlorophyll content. With a view to studying these fertilizer reactions, chlorophyll has been subjected to a detailed chemical study. The exact properties of its component parts, carotin and xanthophyll (which constitute the two yellow pigments) and chlorophyll *a* and chlorophyll *b* (which constitute the two green pigments) have been made. Methods have been devised for the accurate determination of carotin and xanthophyll in plants by spectrophotometric means, and similar studies on the green pigments are under way.

#### PHYSICAL CONDITION OF IRRIGATED SOILS

One of the most obvious effects of alkali injury on irrigated land has to do with the physical condition of the soil. It is well known that soils in which high concentrations of alkali salts have occurred become difficult to bring into good tilth and are relatively impermeable to water when the soluble salts are leached away.

Recent investigations have shown that the influence of alkali salts on the physical condition of the soil is consequent upon reactions that take place between these salts in the soil solution and certain portions of the soil. By these reactions some of the basic or alkaline material of the soil solution—for example, the sodium—enters into combination with some of the soil material, and equivalent quantities of other bases—for example, calcium—may pass from combination with the soil into the soil solution. Such reactions, which are well known and widely utilized in certain industrial processes and in water softening, are known as reactions of base exchange.

In irrigated soils it has been found that such reactions may take place in either direction; that is to say, sodium may pass out of the soil solution into insoluble combination with the soil, or if the soil is already rich in combined sodium and the soil solution is made rich in calcium some of the latter displaces the sodium combined with the soil. When an alkaline soil is irrigated with water rich in calcium salts



or the soil is treated with gypsum the release of combined sodium takes place.

The physical properties of the soil are largely determined by the character of the combined bases. When these combined bases are of the group of strong alkalis, such as sodium or potassium, the soil is easily deflocculated when wet and cements together into hard masses when dry. It is also relatively impermeable to the movement of water through it either when wet or dry. On the other hand, if the combined bases are of the group of weak alkalis, such as calcium or magnesium, the soil tends to flocculate when wet and on drying to crumble or become friable. In this condition it is readily permeable to the movement of water through it.

In view of these relations between the character of the combined bases and the physical condition of the soil it becomes important to be able to determine quantitatively these combined bases. It has been found possible to do this by displacement. When a soil contains combined sodium, for example, the sodium is only slightly soluble in pure water. When a strongly alkaline soil is leached or digested repeatedly with distilled water it continues to give up traces of sodium, which give an alkaline reaction to the water. If such a soil is treated with a dilute solution of a calcium salt, such as calcium sulphate or calcium chloride, the calcium will be absorbed from the solution until a condition of equilibrium is established. This fact makes it possible to measure what may be called the potential alkalinity of a soil by leaching a sample with a solution of a calcium salt of known concentration and by examination of the percolate, to determine the quantity of calcium absorbed and of sodium released.

In a similar way it is possible to determine the total base-exchange capacity of a soil by leaching a sample with a solution of barium chloride of known strength. The barium is absorbed from solution and displaces the combined bases, such as sodium, calcium, and magnesium, which pass into solution and may be identified quantitatively in the percolate. When all of the replaceable bases have been removed from combination with the soil the reaction ceases, and the solution of barium chloride passes through the soil without further modification.

This method of determining the potential alkalinity of an irrigated soil

and also of determining its total quantity of replaceable bases makes it possible to deal more intelligently with the alkali problem on irrigated land than was possible when the character of the soil had to be judged only by an examination of the material it contained in water-soluble form.

#### SOIL MOISTURE IN RELATION TO GROWTH

**Gravitation and the movement of water in soil.**—A new method has been devised for determining the rate and direction of the distribution of water in the soil. The apparatus is so constructed that water passing from the source of supply to a point below the surface of the soil is presented without hydrostatic pressure to aid the downward movement and is free to move in any direction under the combined force of gravity and molecular attraction. The results show that curves passing through points of equal moisture content are symmetrical and that for water presented at this rate gravitation has a negligible influence on the rate of distribution.

**Water requirement of alfalfa.**—The water requirement of alfalfa has come to have a great importance in fixing the duty of water in irrigated regions. Experiments have been started to determine the minimum water requirement of this plant. The first season's work indicates that the artificial conditions made necessary by the accepted method of determining water requirement give results above the minimum. Changes in method are being investigated.

#### DRY-LAND AGRICULTURE

In a region of fluctuating precipitation, such as the Great Plains, where conditions may vary from extreme drought and crop failure to abundant rainfall and bumper crops, it is only through the results of a series of years long enough to be representative of both the average and the extreme conditions to be met that determinations of agricultural practice can be made. This was recognized from the inauguration of comprehensive field experimentation but is further emphasized by each year's extension of the record. While much is still to be desired in the way of knowledge of the possibilities and the best methods of agriculture for this section, the information now in hand is more trustworthy than has been heretofore available.

The results of the work group themselves in three dependent but rather distinct fields: (1) The determination

of the possibilities and limitations of agriculture in each section, (2) the determination of the cultural methods by which individual farmers in each section can realize the greatest and most profitable production, and (3) the determination of fundamental laws and principles of dry farming which may be applied beyond the actual zone of experimentation.

The conservation of moisture is the all-important major problem of dry-land agriculture. This can be subdivided into a very large number of minor problems, such as depth and manner of plowing; tillage after plowing for preparation of a seed bed; intertillage between rows during growth of rowed crops; alternate cropping and summer tillage of various degrees of intensity and at longer or shorter intervals of time; rotations and crop sequence; selection and adaptation of various crops and varieties and strains of crops for different localities and soils; method, rates, and time of seeding; time and methods of harvesting; utilization of crops so as most completely to conserve the scanty rainfall and to insure a continuous supply of sustenance for the farmer's family and his livestock; and the establishment of shelter belts around the farmstead for the protection of the home and the kitchen garden, orchard, small-fruit, and ornamental plantings.

### DEMONSTRATIONS ON RECLAMATION PROJECTS

Following the completion of construction work upon many of the Federal reclamation projects, serious difficulties were encountered in numerous instances by the settlers. In some instances the difficulties are obscure, and their methods of correction, if they can be evolved, will depend upon extended experimentation. In other instances, however, the lack of comprehension of the existing opportunities on the part of the settlers is an important obstacle to the economic development of the project.

On those reclamation projects where the dairy and sheep industries are specially important, there is strong demand for information regarding feasible methods of maintaining dairy cows and small farm flocks of sheep during the summer months. In this connection the use of irrigated pastures is being encouraged and is receiving wide recognition by the settlers.

The work in the production of supplementary feed crops has been done chiefly on the Newlands, Huntley, and Shoshone projects.

Demonstration work in dairying and in the establishment of the swine industry has been conducted on the Newlands, Huntley, Minidoka, Tieton, Shoshone, Boise, North Platte, Uncompahgre, and Belle Fourche projects. In this work the settlers have been assisted in securing stock, improving local dairy herds through breeding and cow testing, controlling diseases, planning and constructing barns and silos, and in improving their methods of feeding and marketing.

### APPENDIX

The following classified list of separate publications and contributed articles written by workers in the Bureau of Plant Industry comprises those issued during the year ended June 30, 1924:

#### FRUITS

- Pruning citrus trees in the Southwest. U. S. Dept. Agr., Farmers' Bul. 1333.
- Culture of citrus fruits in the Gulf States. U. S. Dept. Agr., Farmers' Bul. 1343.
- The coloring of citrus fruit in Florida. *In Proc. Fla. State Hort. Soc.*, v. 36, p. 180-182.
- Coloring Satsuma oranges in Alabama. U. S. Dept. Agr. Bul. 1159.
- Investigations on the freezing of citrus fruit on trees. *In Calif. Citrograph*, v. 9, p. 163, illus.
- Bud selection as related to quantity production in the Washington navel orange. *In Jour. Agr. Research*, v. 26, p. 319-322.
- The solar propagating frame for rooting citrus and other subtropical plants. U. S. Dept. Agr., Dept. Circ. 310.
- Nursery stock investigations. *In Rpt. Iowa State Hort. Soc.*, v. 57, p. 172-176. (Address before Amer. Pomol. Soc.)
- Nursery stock investigations. *In Amer. Florist*, v. 61, p. 469-471. (Address before Amer. Assoc. of Nurserymen.)
- Progress of nursery-stock investigations of the U. S. Department of Agriculture. *In Florists' Exchange*, v. 56, p. 25, 27.
- Commercial control of citrus stem-end rot. U. S. Dept. Agr., Dept. Circ. 293.
- Commercial control of citrus stem-end rot. *In Fla. Grower*, v. 23, no. 18, p. 6, 26. Also in *Citrus Indus.*, v. 4, no. 11, p. 6-7, 34.
- A preliminary report on the control of stem-end rot of citrus fruits by the removal of stems during the coloring process. *In Proc. Fla. State Hort. Soc.*, v. 36, p. 177-179.
- Relative susceptibility of citrus fruits and hybrids to *Cladosporium citri* Massee. *In Jour. Agr. Research*, v. 24, p. 955-959. (With Ala. Agr. Exp. Sta.)
- A new method of grafting. *In Jour. Heredity*, v. 14, p. 399-404. Also in *Gulf Coast Grower*, v. 1, no. 10/11, p. 13-14.
- Quarantine procedure to safeguard the introduction of citrus plants. U. S. Dept. Agr., Dept. Circ. 299.
- Safeguarding the introduction of citrus plants through improved quarantine methods. *In Proc. Fla. State Hort. Soc.*, v. 36, p. 26-31.
- The geography of apple growing in America. *In Rpt. Iowa State Hort. Soc.*, v. 57, p. 102-111.



- The inside story of the apple. *In Amer. Fruit Grower Mag.*, v. 44, no. 1, p. 18; no. 3, p. 5, 12; no. 4, p. 5; no. 5, p. 5; no. 6, p. 5, 13.
- The handling of apples in storage. *In Rpt. Iowa State Hort. Soc.*, v. 57, p. 209-226.
- Physiological studies on apples in storage. *In Jour. Agr. Research*, v. 27, p. 1-38.
- Studies in apple storage: II. *In Marble Laboratory, Inc. (Canton, Pa.), Storage Inves.* 1921/22, p. 17-98.
- Oiled wrappers, oils and waxes in the control of apple scald. *In Jour. Agr. Research*, v. 26, p. 513-536.
- Apple scald and its control. U. S. Dept. Agr., Farmers' Bul. 1380.
- New method of controlling apple scald. *In Amer. Fruit Grower Mag.*, v. 43, no. 8, p. 3.
- Apple bitter-rot cankers in the eastern United States. *In Phytopathology*, v. 13, p. 461.
- Phoma fruit spot of apples. *In Amer. Fruit Grower Mag.*, v. 44, no. 2, p. 14, 28, 53.
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- A new family of spined millipeds from Central China. *In Jour. Wash. Acad. Sci.*, v. 14, p. 103-108.
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- "Bent." *In Bul. Green Sect. U. S. Golf Assoc.*, v. 3, p. 195-197.
- Desirable trees for golf courses. *In Bul. Green Sect. U. S. Golf Assoc.*, v. 4, p. 10-13.
- Transplanting trees. *In Bul. Green Sect. U. S. Golf Assoc.*, v. 3, p. 307-310.
- The size of the putting sward. *In Bul. Green Sect. U. S. Golf Assoc.*, v. 3, p. 314-317.
- Seeding fairways and rough. *In Bul. Green Sect. U. S. Golf Assoc.*, v. 3, p. 215-217.
- Sour soils. *In Bul. Green Sect. U. S. Golf Assoc.*, v. 4, p. 4-5.
- Spreading top dressing. *In Bul. Green Sect. U. S. Golf Assoc.*, v. 3, p. 209-212.
- Brown-patch investigations. *In Bul. Green Sect. U. S. Golf Assoc.*, v. 4, p. 87-92.
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- Suggestions for making compost. *In Bul. Green Sect. U. S. Golf Assoc.*, v. 4, p. 135-137.
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- Report of the Chief of the Bureau of Plant Industry for the fiscal year ended June 30, 1923.
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# REPORT OF THE DIRECTOR OF THE OFFICE OF PUBLICATIONS

UNITED STATES DEPARTMENT OF AGRICULTURE,  
OFFICE OF PUBLICATIONS,  
Washington, D. C., October 15, 1924.

SIR: I have the honor to submit herewith a report on the work of the Office of Publications for the fiscal year ended June 30, 1924.

Respectfully,

L. J. HAYNES,  
*Director of Publications.*

Hon. HENRY C. WALLACE,  
*Secretary of Agriculture.*

A marked increase in the volume of work characterized practically every section of the Office of Publications during the past fiscal year. More new manuscripts were prepared for the Government Printing Office. The congressional demand for our Farmers' Bulletins was particularly heavy. Our Duplicating and Mailing Section was called upon for a much larger volume of work than in any previous year. The general increase in the volume of work at times taxed our employees heavily but they met the situation not only without any increase in personnel but with a considerable reduction in total number.

The general policy of the office, in accordance with that of the entire department, has been to improve where possible and to save where possible. This will be the continued policy.

In spite of a general increase in the total volume of work in the office as a whole, the number of employees was reduced from 227 on July 1, 1923, to 205 on July 1, 1924. This is nearly a 10 per cent decrease, with the result that at the end of the year there were only 10 employees where there were 11 at the beginning of the year. Had the office increased its personnel at the rate the volume of work increased it probably would have required about 10 per cent more employees instead of the decrease of nearly that percentage.

## EDITORIAL WORK

During the fiscal year a total of 461 new manuscripts were sent to the printer. This figure does not include

copies for periodical publications, such as the Experiment Station Record, Crops and Markets and others. There were 63 more manuscripts than the preceding fiscal year, when the number was 398. A total of 114 new Department Bulletins and 85 Farmers' Bulletins, as well as 45 Soil Surveys are included in the total. The following table shows the number of new manuscripts in the various series sent to the printer each year for the last two fiscal years:

Series	Fiscal Year 1923	Fiscal Year 1924
Farmers' Bulletins.....	76	85
Department Bulletins.....	89	114
Department Circulars.....	51	38
Secretary (or Miscellaneous) Circulars.....	11	16
Statistical Bulletins.....	1	5
Service and Regulatory Announcements.....	57	52
Soil Surveys.....	33	45
Miscellaneous Reports, Station Bulletins, etc.....	81	106
Total.....	398	461

The work of the Editorial Section has been expanded by the employment of a statistical editor whose entire time has been devoted to checking statistics and computations in manuscripts submitted for publication. That such checking is necessary is shown by the large number of errors and incorrect figures which have been found. Many of these are due to mistakes in copying, others to failure to check text with

tables, while still others are simple errors in computation.

Public Roads, a journal of highway research, resumed publication with volume 5, No. 1, issued in March. Eight-point solid type was adopted for the Journal of Agricultural Research, which results in giving at least one-fifth more matter at less expense.

Special attention has been given to getting new as well as reprinted publications to a size economical in cost and convenient for the Printing Office to handle. A systematic attempt has been made to avoid awkward and uneconomical 28 and 12 page sizes wherever possible. Many Farmers' Bulletins have been reduced in size by omitting illustrations and by condensing text matter in various places.

It is impossible to estimate accurately at this time just what actual saving has been accomplished. In the case of 72 publications, however, where it was possible to gain from 4 to 32 pages, a total saving amounted to 21,200,000 printed pages, or about 23 per cent of the total.

A marked saving in cost of the game law bulletin was accomplished this year by changing from 6-point leaded full-measure column to 6-point solid half-measure column. There is a very great demand for this publication, the first edition being 250,000 copies. Formerly the publication required 72 pages, but by a revised plan to handle the text matter and by use of solid type in half-measure column it was possible to reduce the size to 40 pages, making a net saving of about \$2,500 on this publication. The bulletin in reference to laws pertaining to fur animals was handled in the same way with a marked saving in cost. This was reduced to a 24-page size from a 36-page size which otherwise would have been necessary. Similar changes have been made in various other publications as already noted. Very often a bulletin may exceed the convenient 24 or 32 page size by only a few lines or a single page, necessitating 4 additional pages, 3 of which will be white space. In cases of this kind an effort has been made to gain enough space in text matter or illustrations to save those extra 4 pages, which, if the edition is large, would cost a considerable sum for paper stock alone.

Formerly the Yearbook of the Department of Agriculture was set in 10-point leaded type, court decisions measure, which is a somewhat smaller type page than octavo measure. On account of the saving possible the Yearbook this year was changed to 10-point

solid type set in octavo measure, which simply meant a little smaller margin at top and sides of the page. It is estimated that the space saved would cost the Government about \$25,000 less money than it would have cost had the material been set in the same style as previous editions. The big saving, of course, is with the Yearbooks printed for Congress, the actual saving to the Department of Agriculture being about \$1,500. Before deciding upon the new form one of the special articles was set the old way and it required 74 pages for text and illustrations. When set up in the new form it required only 56 pages for the same amount of text matter and illustrations. The former method required 32 per cent more pages.

On January 1, 1924, a revised plan was decided upon for publishing statistical information printed in Weather, Crops and Markets, a weekly publication having a distribution of 122,000 copies per week. An investigation showed that about 15,000 persons were interested in the weekly figures and about 115,000 persons chiefly in the monthly summaries. It was decided therefore to have one weekly publication for distribution to the 15,000 persons, a monthly supplement to this weekly for distribution to the 115,000 persons and another weekly containing weather statistics for distribution to about 4,000 persons. The present plan has worked out very satisfactorily, the result being that we print on a good quality of paper 2,430,400 copies yearly at a cost of about \$70,000 as compared with 6,344,000 copies on paper of inferior quality at a total cost of about \$124,000 the old way. This is a saving of more than \$50,000 on this one publication.

## INDEXING SECTION

The fiscal year closed with a brighter outlook for the Index Section than had characterized its beginning and several months preceding. The department library was increasing its efforts to make useful the card index sent it from this office and a plan had been received with favor for an indexed list of available publications. Letters to State directors of extension work proposing the use of this index by county agents and others interested in farm progress have since received favorable responses from nearly every State.

During the year considerable work was done that awaits use. This was due to changes in plans after the work had been authorized. Despite the fact the current needs were not neglected and the indexes of the several series



were about as well up to date as hitherto. The total number of cards written was 46,734, covering a total of 35,882 printed pages.

The indexes made and printed, including the compiling and proof reading, include the following: Yearbook, 1922; Weather, Crops, and Markets, vol. 3 and vol. 4; Crops and Markets, vol. 1; Official Record, vol. 2; Farmers' Bulletins Nos. 1251 to 1275; Department Bulletins Nos. 951 to 975, 1001 to 1025, 1076 to 1100, 1101 to 1125, and 1126 to 1150.

The compiling of the index for the five Yearbooks, 1916-1920, was completed. In addition, many thousand pages of the Daily Digest and of a series of foreign market reports were indexed.

The reading and distribution of the Congressional Record, together with the distribution of other congressional documents, as heretofore occupied considerable time. The indexing of the Record and the filing and care of these publications with the supply of copies from the files for reference formed a part of this work. The number of Records marked and distributed was approximately 2,000 and the number of other congressional documents procured and distributed was about 7,000.

### ILLUSTRATIONS SECTION

There has been a constantly increasing demand for illustrative material not only for the publications of the department but from bureaus and divisions for presentation in special meetings for various educational campaigns. In supplying this demand artists of this office have made about every conceivable kind of illustration and the photographers have visited many States in order to get pictures of the various activities of the department.

During the year the drafting section handled 2,898 jobs, which included drawing graphs, maps, lettering plates, retouching photos, air-brush work, cover page and motion-picture titles, etc.

The photographic section made 109,452 prints, 8,488 negatives, and mounted 10,051 plates. It also prepared 11,444 unbound and 8,600 bound lantern slides, as well as 931 colored lantern slides. The section was called upon to make 3,428 unmounted bromide enlargements, 1,917 mounted enlargements, and 247 colored enlargements.

A total of 24,527 photostats were made, 899 solars, and 94 plain and 4 transparencies.

The enlarging rooms of the section are located several blocks distant from the main laboratory, for which reason there is considerable lost motion in getting orders to and from the proper men, especially such requests as require personal explanation.

A photomicrographic apparatus has been installed and the section is now in better position to handle demands of this nature.

There is a considerable demand from educational institutions for illustrative material, which is sold to them at cost. The proceeds from the sale of photographs during the year amounted to \$1,057.83, which sum was turned in to the Treasury.

### ANNOUNCEMENT OF NEW PUBLICATIONS

The former 4-page leaflet form for announcing publications printed during the preceding month has been superseded by a postal-card form which is mailed out as occasion warrants. This change has resulted in a considerable saving, not only in the cost of publishing the announcements, but also in the clerical work involved. When the 4-page leaflet form was used applicants filled in their names and addresses in the space provided, checking the publications desired, and returned the list to the Office of Publications.

A big advantage in the revised plan is that on the face of each card appears the stenciled name and address of the person who wants the publications. When a request is made for one or more publications, all that the addressee is required to do is to check those desired and return the card in an envelope addressed to this office. The address having been stenciled on the card by the addressograph equipment no time is lost in trying to decipher poor writing and omitted addresses. Formerly thousands of lists came back with such poorly written signatures that a great deal of time was consumed in deciphering them.

### DISTRIBUTION SCHEMES

The automatic distribution of publications to persons who have not specifically requested them is wasteful and uneconomical. When such a system is practiced extensively many publications are sent to persons not particularly interested in them. The result is that the available stock is so

depleted that a great many worthy requests can not be complied with.

A scheme of distribution ordinarily accompanies a manuscript. This scheme indicates certain lists to which the publication is to be distributed when printed, this being on the assumption that every person on each list will be interested in the publication. Instead of sending the publication to all persons on these lists, a better plan would seem to be to send an announcement card, with an explanation that the publication can be obtained free on request.

An example of how an announcement post card saves publications is in the case of Yearbook Separate 897, "Farm Ownership and Farm Tenancy," this being a study in which bankers are particularly interested. It was first suggested that the publication be sent to all bankers, which would have required more than 30,000 copies. Instead of mailing an unsolicited copy to each banker, it was decided to send an announcement card, calling attention to the publication and pointing out that it would be sent to those who returned the card. Of the more than 30,000 cards sent out, less than 5,000 were returned, thus saving approximately 25,000 copies of this particular publication. To have sent this publication to 30,000 bankers would have cost about \$1,350 as compared with \$225 for the 5,000 copies for those who requested it, saving approximately \$1,125.

Other examples of how an announcement card has resulted in decided savings could be cited. In each case the result has been that a large percentage of the stock has been conserved for those sufficiently interested in the subject matter to make specific request. During the next fiscal year the Office of Publications contemplates the more extensive use of announcement cards and it is planned to detail an experienced person to handle the work.

It is the opinion of this office that it is possible to make department publications too easily obtainable. If a person will go to a little personal trouble to obtain a publication, that person on the average will appreciate and regard the publication with a little more respect than if he gets the same publication unsolicited and without any effort on his part. It seems to this office that the Department of Agriculture is serving the public sufficiently with free publications when it sends an announcement of its publications to interested mailing lists. A person really interested in a publication should not object to a policy which requires

him to ask for it and to spend a cent or two in postage in transmitting his or her request to the department.

It is realized that such a policy probably should not include those publications which are of an educational nature, such as barberry and tick eradication. Some of the bureaus already make a practice of such a plan with their scientific publications. A single postcard, which can be put in an envelope and mailed back to the department is preferable to a double postcard for an announcement of this nature. On a double postcard, which is more awkward for the addressing machines to handle and also for the Post Office Department to handle, it is ordinarily necessary for the applicant to write in his name and address by hand, while with the single postcard the name and address is put on with the addressing machine and there is no difficulty in deciphering poorly handwritten names and addresses, when the cards are returned.

#### DISTRIBUTION OF PUBLICATIONS

A total of 31,127,519 publications were distributed during the fiscal year ending June 30, 1924. Of the number distributed, 18,746,573 were miscellaneous publications, i. e., other than Farmers' Bulletins. About 12,380,946 of the latter class of publications were distributed.

The total number of publications available for distribution during the last fiscal year was 42,576,511, of which number 31,215,363 were issued, leaving 11,361,148 publications on hand at the beginning of the fiscal year. The increase in the total number of publications distributed over the previous year was 1,151,047.

There is a large amount of detailed clerical work in connection with the distribution of nearly 32,000,000 publications. There were received from Members of Congress 29,732 letters. In compliance with the requests contained therein, 37,752 orders were issued on the Superintendent of Documents; 276,257 franks were counted; 114,480 checked lists were examined and totals computed; bulletins requested on 85,160 subject lists were transcribed to work sheets to facilitate the mailing of publications in the Office of the Superintendent of Documents. A large percentage of the congressional distribution is the result of telephone calls, 16,527 of which were received at the central desk in this office during the year just closed.

There was a very heavy demand for "Lists of Farmers' Bulletins," 9,737,000



of which were furnished to Members of Congress.

Quite a departure from the old lists was made in the printing of the List of Farmers' Bulletins during the past year. A new list was arranged by subject matter instead of by numbers. This change proved very popular with Members of Congress and their constituents. Because of the bins in which the Farmers' Bulletins are stored being arranged in numerical order, it was found necessary to transcribe the returned checked lists so as to cause them to fall in numerical order to facilitate the mailing of publications. A plan was worked out whereby "work sheets" were furnished to Members of Congress, and it is a pleasure to state that more than 200 offices agreed to cooperate with us, and that the work of distributing the Farmers' Bulletins was greatly expedited thereby. The distribution of these lists by Members of Congress makes for one of the largest contacts with the general public. It affords every section of the country an opportunity to secure the useful information gathered by the department.

In connection with the distribution of Farmers' Bulletins, an account is kept with each Member of the House and Senate. There is also a stock record kept of the distribution of each individual bulletin. From these records we are continually furnishing information and compiling reports.

The demand for publications and information from miscellaneous applicants continued large during the year, as will be shown by the following record of the various phases of the work:

Number of communications received.....	572, 637
Miscellaneous orders made on the Superintendent of Documents.....	110, 168
Farmers' Bulletins orders made on Superintendent of Documents.....	391, 204
Postal cards and forms addressed and mailed.....	80, 936
Number of communications referred.....	55, 490
Addresses written for other bureaus.....	1, 826

Despite the constant publication of the fact that the department does not sell publications, \$3,581.74 was received in this office last year. The greater portion of this amount, \$2,880.50, was forwarded to the Superintendent of Documents, Government Printing Office, and \$180.77 was sent to other departments. Owing to the fact that some publications requested were for free distribution, \$520.47 was returned to persons sending a remittance.

Much correspondence is required in conducting the work of distribution of publications, although it is reduced to a very large extent by the use of many forms. In addition to these, 14,350 dictated letters were required

and 26,148 form letters written, which together with 2,759 letters referred to other offices made a total of 43,257 letters handled. This work was all done by members of the stenographic pool, who also cooperated by cutting 425 stencils and 1,500 graphotype plates for the Addressing, Duplicating, and Mailing Section, as well as doing clerical work required in handling 32,000 Monthly List requests.

While the records of distribution show an increase for the past year in the number of publications distributed (more than a million copies) this number would have been greatly increased had it been possible to keep a larger percentage of the Farmers' Bulletins in stock.

#### DISTRIBUTION OF PUBLICATIONS TO FOREIGN COUNTRIES

During the last fiscal year 215,792 publications were distributed to addresses in foreign countries. These publications were sent upon the request of the various bureaus and aggregated 5,108 orders. To send the publications called for in these orders involved the preparation of 180,817 packages, weighing 45,820 pounds and 9 ounces, or more than 20 tons. The total cost to send this enormous amount of printed matter was \$3,458.79.

By far the greater part of the publications sent to foreign countries, 173,487 packages, was sent under postage at a cost of \$3,113.99, while 7,330 packages were sent through the Smithsonian International Exchange, at a cost of \$344.80. The total number of packages sent last year was 48,018 more than the previous year, and cost \$791.99 more to send. Publications of the department were sent to 93 foreign countries.

#### MONTHLY DISTRIBUTION OF FARMERS' BULLETINS

The demand for Farmers' Bulletins varies greatly during the year. The following table shows the distribution each month for the fiscal year. The first column shows the number distributed by Senators, another column those distributed by Representatives, another total distributed by Congress, another those distributed by the department, and the last column the total distributed by both Congress and the Department of Agriculture.

It is seen from an examination of this table that the Distribution Section is much busier during the winter and spring months than during the summer months.



In April, for example, our clerks had to handle requests which called for 1,725,689 bulletins. This is more than three times the number sent out in July. Likewise there is a considerable variation from month to month. It is not practical to increase or decrease the number of employees in proportion to the increase or decrease in number of requests received.

During the year a total of 12,380,946 Farmers' Bulletins were distributed by Congress and by the Department of Agriculture. Of this number 7,618,936, or more than 60 per cent, were sent out on congressional requests and 4,762,010 on requests sent direct to the department. The monthly average distribution of Farmers' Bulletins was 1,031,745.

Details for each month are shown in the following table:

Month	By Congress	By department	Total
July.....	232,428	340,701	573,129
August.....	293,669	420,029	713,698
September.....	389,827	487,717	877,544
October.....	544,228	450,966	995,194
November.....	452,961	302,056	755,017
December.....	495,364	332,648	828,012
January.....	631,832	361,079	992,911
February.....	794,612	447,314	1,241,926
March.....	1,117,572	342,342	1,459,914
April.....	1,395,823	330,866	1,726,689
May.....	720,852	690,784	1,411,636
June.....	549,768	255,508	805,276
Year.....	7,618,936	4,762,010	12,380,946
Monthly average	634,911	396,834	1,031,745

### MAILING LIST RECORD WORK

On August 1, 1923, a section was created to take care of the mailing list record work. Mailing lists for the entire department are being handled by this section, the work of which has been growing steadily.

Much constructive work has been done along the line of standardization of lists. There is a strict follow-up system of notifications in the various bureaus in regard to changes in address, drops, duplicating, etc., the idea being to make this section a real clearing house for all department mailing lists. It is believed that the mailing lists are now in better shape than ever before. A fine spirit of cooperation on the part of the bureaus concerned has made this possible.

The master index on July 1, 1924, contained a total of 525,659 names, which compares with 544,495 a year ago. There are 194 lists maintained

at the Government Printing Office and 613 in the Addressing, Duplicating, and Mailing Section, which make a total of 807 lists for the entire department. During the year 47 new lists were created and 23 old ones destroyed or combined with other lists.

Names in the master index are arranged by State and town. This change having been made from a straight alphabetical arrangement.

The following summary shows a marked increase in the volume of work over that for the year 1923, but owing to the inauguration of new methods the work has been short cut so that it has been handled with a smaller personnel than during any previous year:

	1923	1924
Lists maintained at Government Printing Office.....	195	194
Lists maintained at Addressing, Duplicating, and Mailing Section.....	588	613
Total lists of the department.....	783	807
New lists created.....	0	47
Lists destroyed (or combined with other lists).....	0	23
Total names on all lists.....	544,495	525,659
Communications received.....	89,000	97,182
Communications answered.....		82,467
Addresses added.....	57,379	88,586
Addresses dropped.....	27,089	61,342
Addresses alphabetized.....	160,936	299,656
Addresses forwarded to Government Printing Office.....	135,480	120,321
Addresses forwarded to Addressing, Duplicating, and Mailing Section.....	51,000	83,507

The compilation of a new catalogue, in card form, of the department mailing lists has been completed. After a survey of the bureaus the card catalogue was adopted as being more flexible, easier to maintain accurately, and more accessible than the previous book. While the furnishing of information to the bureaus for the accurate upkeep of this new catalogue will add to the work of the section, it is believed that much will be gained from a distribution standpoint by assisting the bureaus in maintaining a catalogue which will at all times be up to date.

### ADDRESSING, DUPLICATING, AND MAILING

The volume of work handled by the Addressing, Duplicating, and Mailing Section during the year was the largest since all work of this nature was consolidated into a central section under the direction of this office. There was a considerable increase over the preceding year in practically all lines of work done in this section.

There is a great variation in work we are called upon to do from month to month. This great fluctuation makes it almost impossible to handle all work as promptly as might be desirable, especially when it is impossible to increase or decrease the number of employees in proportion to the volume of work. The general situation could be improved greatly if bureaus would make their requests as far in advance of date desired as possible. An analysis of the demands for mimeograph and multigraph work for 18 months since consolidation shows a fluctuation in quantity of work ordered from week to week and from month to month. The average for 4-week periods varied from 495,000 to 1,228,000 pages per week, the high point being nearly 150 per cent greater than the low period. The section has been able to keep up with the increased demand by a rearrangement of the work in such a way that operators can be shifted from one division to another. The following tabulations show in detail the volume of multigraph and mimeograph work done for the various bureaus and it also gives a summary of miscellaneous work in the addressing and duplicating sections.

### Multigraph work

Bureau or office	Jobs	Copies	Pages	Seg-ments
Accounts.....	25	27,810	27,810	25
Agricultural Economics.....	720	5,698,077	7,239,157	1,174
Animal Industry.....	56	110,350	149,350	80
Biological Survey.....	100	122,895	137,375	115
Chemistry.....	153	233,455	298,155	177
Entomology.....	61	77,150	81,150	70
Federal Horticultural Board.....	62	217,650	239,150	80
Fixed Nitrogen Laboratory.....	6	42,800	42,800	8
Forest Service.....	36	178,240	181,440	48
Grain Futures Administration.....	15	37,550	80,500	18
Home Economics.....	9	34,050	36,100	12
Insecticide and Fungicide Board.....	16	15,300	15,300	16
Library.....	19	38,125	28,125	19
Packers and Stockyards Administration.....	38	153,605	164,105	41
Plant Industry.....	238	1,033,124	1,734,309	521
Public Roads.....	6	7,525	12,050	7
Secretary.....	643	4,197,313	4,898,895	1,141
Soils.....	9	11,800	11,800	9
Weather.....	1	500	500	1
Total.....	2,213	12,267,319	15,408,071	3,562

### Mimeograph work

Bureau or office	Jobs	Copies	Pages
Accounts.....	21	5,075	45,130
Agricultural Economics.....	2,974	4,425,174	13,634,529
Animal Industry.....	653	486,069	1,442,786
Biological Survey.....	207	141,169	437,361
Chemistry.....	326	127,784	542,017
Entomology.....	121	63,668	350,107
Federal Horticultural Board.....	142	223,573	642,229
Fixed Nitrogen Laboratory.....	4	3,219	5,349
Forest Service.....	222	238,724	1,649,911
Grain Futures Administration.....	14	8,250	46,850
Home Economics.....	57	49,585	139,642
Insecticide and Fungicide Board.....	26	5,871	10,174
Library.....	1	100	200
Packers and Stockyards Administration.....	397	85,388	437,654
Plant Industry.....	580	219,577	950,837
Public Roads.....	117	65,832	191,179
Secretary.....	1,224	696,577	3,013,674
Soils.....	34	12,172	31,702
Weather.....	7	5,265	7,380
Total.....	7,127	6,893,072	23,578,711

### Summary of miscellaneous work

Envelopes and franks addressed.....	5,598,692
Dermatype stencils cut.....	21,121
Stencils mimeoscoped.....	1,588
Number of sheets perforated.....	49,475
Plates embossed.....	111,032
Plates corrected.....	10,647
Plates added.....	31,461
Plates removed.....	18,727
Sheets assembled.....	14,881,030
Sheets folded.....	9,697,184
Copies stapled.....	1,558,690
Envelopes sealed.....	2,857,823
Items inserted.....	5,060,412
Pads made.....	38,511
Sheets of paper cut.....	13,126,944
Round holes cut.....	846,370
Holes punched.....	43,950
Metal tags embossed.....	4,750

### Miscellaneous distribution

497 Farmers' Bulletin orders amounting to.....	77,145 copies
5,034 miscellaneous orders amounting to.....	6,157,035 copies

### MIMEOGRAPHING ON TWO SIDES OF A SHEET

The utilization of both sides of a sheet for mimeograph and multigraph work has been extended and encouraged wherever possible. Printing on only one side not only doubles the cost of the paper to the bureau but it more than doubles the work in hand assembling. A careful investigation by this office indicates that those who get our reports really prefer the less bulky, two-sides-of-a-sheet job.

In order to determine the preference of those who get such reports, a questionnaire was sent to each one on a list of prominent officials and others who get one of the monthly reports. A few days after the change from mimeographing on one side only to both sides of the sheet a questionnaire was sent to each person on the list. Each person was asked to consider the two sides of a page report just received with the one side of a page job formerly issued. The following is a summary of the reports to the questionnaires.

99.7 per cent said the issue printed on two sides was satisfactory.

99.7 per cent said the issue was as satisfactory on two sides as on one side only.

99.1 per cent recommended that future issues be printed on both sides.

95.6 per cent preserved their copies for future reference.

Many who replied to the questionnaire said they preferred the material on two sides, because being more compact in this form it required less file space. As a result of this investigation several reports formerly printed on one side were changed so as to utilize both sides of the sheet, which, as noted before, cuts the cost of the paper in half and greatly reduces the clerical work of assembling. Another consideration is that in this form the post office has less bulk to handle.

On individual publications the saving possible by material on two sides may not seem to be much of an item and may amount to only \$5 or \$10, but when the combined work of the various bureaus and offices is considered it amounts to a considerable sum during the year.

#### EXPENDITURE OF PRINTING FUND

Congress appropriated \$760,000 for printing and binding for the year. Expenditures, which include bills for delivered work and estimates for work not yet delivered, amounted to \$759,611.52 as of September 30, 1924, leaving a balance of only \$388.48.

The Congressional Joint Committee on Printing authorized the expenditure of not to exceed \$2,500 for field printing, of which a total of \$1,387.41 was used. This sum includes audited bills and approved estimates as of September 30, 1924.

The two popular books "Diseases of the Horse" and "Diseases of Cattle" were revised and reprinted, these being paid for from a special congressional appropriation of \$200,000. An edition of 199,000 copies of each volume was

issued, distribution being made exclusively by Members of Congress, and not under control of the Department of Agriculture.

The following tabulation shows how the printing and binding appropriation was spent or obligated, by bureaus, this statement being as of September 30, 1924, and subject to change in accordance with the variation of actual bills from the amounts estimated:

Bureau or office	Liability
Accounts.....	\$1, 115. 35
Agricultural Economics.....	67, 868. 79
Animal Industry.....	36, 641. 39
Biological Survey.....	8, 171. 65
Chemistry.....	8, 327. 91
Editorial and Distribution Work.....	110, 341. 81
Entomology.....	11, 350. 18
Federal Horticultural Board.....	3, 760. 04
Forest Service.....	57, 534. 05
Fixed Nitrogen Laboratory.....	445. 92
Grain Futures Administration.....	1, 619. 44
Home Economics.....	2, 502. 37
Insecticide and Fungicide Board.....	750. 47
Journal of Agricultural Research.....	28, 899. 35
Library.....	11, 916. 79
Packers and Stockyards Administration	280. 79
Plant Industry.....	30, 124. 19
Public Roads.....	10, 425. 45
Office of Secretary.....	21, 506. 94
Office of Experiment Stations.....	29, 129. 57
Office of Cooperative Extension Work.....	12, 685. 02
Soils.....	37, 530. 20
Weather.....	52, 648. 41
	<hr/> 545, 576. 08
Farmers' Bulletins:	
New.....	53, 753. 98
Congressional reprints.....	160, 281. 46
	<hr/> 759, 611. 52

#### NEW PUBLICATIONS RECEIVED

During the year more than 500 new publications of a bulletin or circular nature were delivered by the Government Printing Office. The total editions amounted to more than 7,000,000 copies.

Included in the number of new titles are 77 Farmers' Bulletins, of which 3,973,643 copies were printed, and 74 new Department Bulletins, of which 380,500 copies were printed. There were 42 new Department Circulars, 34 Soil Surveys, and 92 separates printed from the Journal of Agricultural Research. The list of the new publications which follows does not quite correspond with those ordered from the current year's printing fund because those printed and delivered include a considerable number of titles ordered and paid for out of last year's appropriation, but delivered during the year; nor does it include several new publications which were ordered but not delivered during the year.



*Publications issued and distributed*

Series	New		Reprinted		New and reprinted		Distributed
	Titles	Copies	Titles	Copies	Titles	Copies	
	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>
Farmers' Bulletins.....	77	3, 973, 643	318	6, 781, 374	395	10, 755, 017	12, 380, 946
Department Bulletins.....	74	380, 500	45	116, 000	119	496, 500	460, 502
Department Circulars.....	42	392, 500	15	174, 000	57	566, 500	672, 155
Secretary and Miscellaneous Circulars.....	16	1, 330, 500	5	40, 500	21	1, 371, 000	429, 435
Statistical Bulletins.....	3	13, 500	-----	-----	3	13, 500	8, 391
Yearbook Separates.....	14	120, 500	7	11, 500	21	132, 000	155, 667
Soil Surveys.....	34	34, 000	-----	-----	34	34, 000	21, 243
Service and Regulatory Announcements.....	47	296, 500	6	12, 000	53	308, 500	320, 745
J. A. R. reprints.....	92	134, 126	-----	-----	42	134, 126	130, 930
Farmers' Bulletin Lists.....	-----	-----	3	10, 700, 000	3	10, 700, 000	9, 737, 000
Miscellaneous.....	136	983, 265	27	74, 110	163	1, 057, 375	1, 183, 625
Total.....	535	7, 659, 034	426	17, 909, 484	961	25, 568, 518	25, 500, 639
Periodical publications:							
Journal of Agricultural Research.....	45	90, 000	-----	-----	45	90, 000	85, 425
Experiment Station Record.....	18	122, 850	-----	-----	18	122, 850	117, 820
Weather, Crops, and Markets.....	26	3, 034, 000	-----	-----	26	3, 034, 000	3, 034, 000
Crops and Markets.....	31	1, 287, 000	-----	-----	31	1, 287, 000	1, 287, 000
Public Roads.....	4	12, 000	-----	-----	4	12, 000	10, 835
Official Record.....	51	816, 000	-----	-----	51	816, 000	816, 000
Clip Sheet.....	51	255, 000	-----	-----	51	255, 000	255, 000
Weather Review.....	13	20, 800	-----	-----	13	20, 800	20, 800
Total.....	239	5, 636, 650	-----	-----	239	5, 636, 650	5, 626, 880
Grand total.....	774	13, 295, 684	426	17, 909, 484	1, 200	31, 205, 168	31, 127, 519

## NEW FARMERS' BULLETINS

No.	Title	Copies
1311	Chrysanthemums for the Home.....	60, 000
1317	Marketing Main-Crop Potatoes.....	30, 000
1321	Fumigating Citrus Trees for Insects.....	30, 000
1323	Wheat Strawworm Control.....	20, 000
1324	Lamb and Mutton in the Diet.....	59, 890
1325	Social Aspects of Rural Planning.....	60, 000
1326	Codling Moth in Pacific Northwest.....	30, 000
1329	Boll-Weevil Problem.....	146, 625
1330	Parasitic Diseases of Sheep.....	19, 710
1331	Back Yard Poultry Keeping.....	105, 000
1333	Pruning Citrus Trees in the Southwest.....	30, 000
1334	Tanning Leather and Small Skins.....	60, 000
1335	Gipsy and Brown-tail Moth.....	25, 000
1336	Feeding Young Dairy Stock.....	115, 000
1337	Diseases of Poultry.....	170, 000
1338	Tomatoes as a Truck Crop.....	60, 000
1339	Red Clover Culture.....	60, 000
1340	Polish and Poulard Wheats.....	30, 000
1341	Mule Production.....	40, 000
1342	Dairy-Barn Construction.....	60, 000
1343	Citrus Fruits in the Gulf States.....	30, 000
1344	Strawberry Rootworm on Greenhouse Rose.....	30, 000
1345	Root-Knot, Its Cause and Control.....	30, 000
1346	Carpet Beetles and Their Control.....	30, 000
1347	American Breeds of Chickens.....	150, 000
1348	Corrugation Method of Irrigation.....	30, 000
1349	Increasing Potato Crop by Spraying.....	30, 000
1350	Beef-Cattle Barns.....	30, 000
1351	Cabbage Diseases.....	40, 000
1352	Tobacco Flea-Beetle.....	20, 000
1353	Clothes Moth Control.....	80, 000

## NEW FARMERS' BULLETINS—Continued

No.	Title	Copies
1354	Yellow-Fever Mosquito.....	30, 000
1355	Blackleg.....	60, 000
1356	Tobacco Hornworm Insecticide.....	19, 850
1357	Castration of Hogs.....	29, 700
1358	Growing Rye in Western States.....	30, 000
1359	Milk, and Its Uses in the Home.....	149, 685
1361	Brahman (Zebu) Cattle.....	10, 000
1362	Insects Injurious to Ornamental Greenhouse Plants.....	30, 000
1363	Natural and Artificial Incubation of Hens' Eggs.....	90, 000
1364	Important Pecan Insects and Their Control.....	20, 000
1365	Clover Failure.....	29, 350
1366	Production of Maple Sirup and Sugar.....	25, 000
1367	Control of Potato-Tuber Diseases.....	30, 000
1368	Breaking and Training Colts.....	30, 000
1369	Bridge Grafting.....	29, 960
1370	Dahlias for the Home.....	100, 000
1371	Vegetable Diseases and Insects.....	80, 000
1373	Homing Pigeons.....	20, 000
1374	Care of Food in the Home.....	130, 000
1375	Game Laws for 1923-24.....	249, 700
1376	Natural and Artificial Brooding of Chickens.....	39, 695
1377	Marketing Poultry.....	80, 000
1378	Marketing Eggs.....	80, 000
1379	Beef Production in the Cotton Belt.....	30, 000
1380	Apple Scald and Its Control.....	60, 000
1382	Fattening Steers in the Corn Belt.....	30, 000
1383	Food Values and Body Needs Shown Graphically.....	110, 000
1385	Buying a Farm in an Undeveloped Region.....	50, 000

## NEW FARMERS' BULLETINS—Continued

No.	Title	Copies
1386	Terracing Farm Lands.....	15,000
1387	Laws Relating to Fur Animals, 1923-24.....	60,000
1388	Social Aspects of Recreational Places.....	70,000
1389	Sorgo Sirup Manufacture.....	20,000
1390	Vegetable Seeds for the Home and Market Garden.....	29,478
1391	The Guinea Fowl.....	20,000
1393	Principles of Dairy-Barn Ventila- tion.....	60,000
1394	Watermelons.....	30,000
1397	Mouse Control in Field and Orchard.....	20,000
1400	Establishing Cranberry Fields.....	30,000
1402	Cranberry Harvesting and Hand- ling.....	30,000
1404	Pumping from Wells for Irriga- tion.....	30,000
1405	The Windbreak as a Farm Asset.....	15,000
1407	The Mexican Bean Beetle in the East.....	30,000
1408	The House Fly and How to Sup- press It.....	30,000
1409	Turkey Raising.....	40,000
1410	Control of Brown-Rot of Prunes and Cherries in the Pacific Northwest.....	30,000
1417	Idle Land and Costly Timber.....	50,000
	Total.....	3,973,643

## NEW DEPARTMENT BULLETINS

No.	Title	Copies
1150	Accounting Records for Live- stock Shipping Associations.....	5,000
1158	Production of Sirup from Sweet Potatoes.....	4,500
1159	Coloring Satsuma Oranges in Alabama.....	4,000
1162	The Role of the Genus <i>Rhamnus</i> in the Dissemination of Crown- Rust.....	4,000
1163	A Study of Decay in Douglas Fir in the Pacific Northwest.....	7,000
1164	Segregation and Correlation of Characters in an Upland- Egyptian Cotton Hybrid.....	3,500
1165	Report on Bird Censuses in the United States 1916 to 1920.....	7,000
1166	Apple By-Products as Stock Foods.....	3,500
1167	Cultivation of the True Yams in the Gulf Regions.....	4,000
1168	Wearing Qualities of Shoe Leath- ers.....	7,000
1169	Further Studies with Paradi- chlorobenzene for Peach Borer Con- trol with Special Reference to its use on Young Peach.....	5,000
1170	Effects of Different Systems and Intensities of Grazing Upon the Native Vegetation at the North- ern Great Plains Field Station.....	7,500
1171	The Manufacture of Camembert Cheese.....	3,000
1172	Cereal Experiments at Chico, California.....	3,000
1173	Experiments in Wheat Produc- tion in the Dry Lands of the Western United States.....	6,500
1174	Hungarian Vetch.....	3,000
1175	Grain-Sorghum Experiments at the Woodward Field Station in Oklahoma.....	3,000

## NEW DEPARTMENT BULLETINS—Continued

No.	Title	Copies
1176	Some Results of Cutting in the Sierra Forests of California.....	4,500
1177	Irrigation District Operation and Finance.....	5,000
1178	Bordeaux-oil Emulsion.....	12,000
1179	Investigations on the Manufac- ture of Phosphoric Acid by the Volatilization Process.....	4,000
1180	Field Experiments with Atmos- pheric Nitrogen Fertilizers.....	5,000
1181	Labor Requirements of Arkansas Crops.....	8,000
1182	The Imported Pine Sawfly.....	3,500
1183	Milling and Baking Experiments with American Wheat Varieties.....	12,000
1184	Utilization of Pima Cotton.....	5,000
1185	Flax-stem Anatomy in Relation to Retting.....	4,000
1186	White-Pine Blister Rust in West- ern Europe.....	13,000
1187	Experimental Milling and Baking.....	14,000
1188	Costs and Farm Practices in Pro- ducing Potatoes.....	5,000
1189	Fruits in West Virginia, Ken- tucky, and Tennessee.....	9,000
1190	Effect of Feeding Green Alfalfa and Green Corn on Flavor and Odor of Milk.....	6,000
1191	Potash from Kelp: Early Devel- opment of the Giant Kelp.....	2,000
1192	Improvement in Kubanka Durum Wheat by Pure-Line Selection.....	5,000
1193	Colloidal Material in Soils by Ab- sorption.....	4,000
1194	A Chemical and Structural Study of Mesquite, Carob, and Honey Locust Beans.....	3,000
1195	Sterilities of Wild and Cultivated Potatoes with Reference to Breeding from Seed.....	5,000
1196	Food and Economic Relations of North American Grebes.....	5,000
1197	Experiments with Emmer, Spelt and Einkorn.....	4,000
1198	Cost of Producing Winter Wheat in Central Great Plains of the United States.....	4,000
1199	List of Bulletins of the Agricul- ture Experiment Stations in the United States from their Estab- lishment to the end of 1920.....	1,000
1200	The Natural Regeneration of Douglas Fir in the Pacific Northwest.....	6,000
1201	Plants Tested for, or Reported to Possess, Insecticidal Properties.....	6,000
1202	Tractors and Horses in the Winter. Wheat Belt; Oklahoma, Kansas, and Nebraska, 1921.....	6,000
1203	Experimental Production of Straw Gas.....	10,000
1204	Dusting Cotton from Airplanes.....	4,000
1205	Dusting and Spraying Peach Trees after Harvest for Control of the Plum Curculio.....	3,000
1206	Marketing Southern Grown Sweet Potatoes.....	5,000
1207	Drainage District Assessments.....	4,000
1208	Effect of Feeding Turnips on the Flavor and Odor of Milk.....	6,000
1209	Effects of Selection on the Yield of a Cross Between Varieties of Corn.....	7,000
1210	Summary of Literature on Bunt, or Stinking Smut of Wheat.....	3,500
1211	Sources of Supply and Conditions of Employment of Harvest Labor in the Wheat Belt.....	3,000
1212	The Woolly-Pod Milkweed ( <i>Asclepias Ericarpa</i> ) as a Poi- sonous Plant.....	3,500

## NEW DEPARTMENT BULLETINS—Continued

No.	Title	Copies
1213	Digestibility of Raw Starches and Carbohydrates.....	5, 000
1214	Family Living in Farm Homes.....	10, 000
1216	Tentative Standard Methods of Sampling and Testing Highway Materials.....	6, 000
1215	The Chinese Jujube.....	5, 500
1219	Delinting and Recleaning Cotton Seed for Planting Purposes.....	5, 000
1220	Farm Labor in Massachusetts 1921.....	3, 000
1221	The Capillary Distribution of Moisture in Soil Columns of Small Cross Section.....	4, 000
1222	Growth and Feeding of Honeybee Larvæ.....	6, 000
1224	Relation of Land Income to Land Value.....	1, 000
	Relation of Land Income to Land Value (with Appendix).....	1, 500
	Relation of Land Income to Land Value (without Appendix).....	1, 500
1225	The Camphor Thrip.....	3, 000
1226	The Recovery of Potash as a By-Product in the Blast Furnace Industry.....	4, 000
1228	Results of Experiments with Miscellaneous Substances Against the Chicken Mite.....	3, 000
1229	The Stem Nematode <i>Tylenchus dipsaci</i> , on Wild Hosts in the Northwest.....	3, 000
1230	Conditions Affecting the Demand for Harvest Labor in the Wheat Belt.....	4, 000
1231	Tests of Methods of Protecting Woods Against Termites or White Ants.....	3, 000
1232	Damage by Termites in the Canal Zone and Panama and How to Prevent It.....	3, 000
1234	Agricultural Survey of Europe. The Danube Basin. Part I.....	5, 000
1237	Organization and Development of a Cooperative Citrus-Fruit Marketing Agency.....	7, 500
1239	Studies in the Physiology and Control of Bunt or Stinking Smut of Wheat.....	3, 000
1240	The Meadow Death Camas as a Poisonous Plant.....	3, 000
	Total.....	380, 500

## NEW DEPARTMENT CIRCULARS

No.	Title	Copies
265	Arbor Day.....	11, 000
267	The Work of the Newlands Reclamation Project Experiment Farm.....	2, 500
270	Extension Work in Agricultural Engineering, 1922.....	6, 000
273	Flag Smut of Wheat.....	5, 000
275	The Work of the Huntley Reclamation Project Experiment Farm in 1921.....	2, 500
276	Inspection of Milk Supplies.....	8, 000
277	Crop Tests at the Cooperative Testing Station, Sacaton, Ariz.....	5, 500
278	The Commercial Classification of American Cotton.....	14, 000
279	Greasewood as a Poisonous Plant.....	3, 500
280	Kota Wheat.....	5, 000

## NEW DEPARTMENT CIRCULARS—Continued

No.	Title	Copies
281	Potato Brown Rot.....	10, 000
282	The Australian Tomato Weevil Introduced in the South.....	5, 000
283	Livestock Poisoning by Cocklebur.....	4, 000
285	Status and Results of Home Demonstration Work, Northern and Western States, 1921.....	30, 000
286	The Chayote: Its Culture and Uses.....	6, 000
287	The Occurrence of Diseases of Adult Bees.....	15, 000
288	The Puss Caterpillar and the Effects of its Sting on Man.....	3, 500
289	The Work of the Scottsbluff Experiment Farm in 1920 and 1921.....	3, 000
290	United States Grades for Rough Rice.....	11, 000
291	United States Grades for Milled Rice.....	11, 000
292	Slash Disposal in Western White Pine Forests in Northern Idaho.....	5, 000
293	Commercial Control of Citrus-Stem Rot.....	12, 000
294	The Rat Mite Attacking Man.....	3, 000
295	Basic Grading Rules and Working Stresses for Structural Timbers.....	6, 000
296	Standard Grading Specifications for Yard Lumber.....	26, 000
297	The Eel-Worm Disease: A Menace to Alfalfa in America.....	10, 000
298	Directory of Officials and Organizations Concerned with the Protection of Birds and Game, 1923.....	5, 000
299	Quarantine Procedure to Safeguard the Introduction of Citrus Plants.....	5, 000
300	Commercial Cuts of Meat.....	9, 000
301	Introduction of Parasites of the Alfalfa Weevil into the U. S.....	3, 000
302	Farm Management Extension, Early Development and Status in 1922.....	6, 000
303	The Hot-water Treatment of Sugar Cane for Insect Pests: A Precaution.....	10, 000
305	Electrochemical Treatment of Seed Wheat.....	4, 000
306	Statistics of Cooperative Extension Work, 1923-24.....	3, 000
307	A Method of Testing Farm Management and Cost of Production Data for the Validity of Conclusions.....	4, 000
308	An extension Program in Range Livestock, Dairying, and Human Nutrition for the Western States.....	25, 000
309	Spraying Strawberries for the Control of Fruit Rots.....	6, 000
310	The Solar Propagating Frame for Rooting Citrus and Other Subtropical Plants.....	4, 000
311	Cabbage-seed Treatment.....	15, 000
316	Methods and Results of Cooperative Extension Work Reported Through County Agricultural Agents 1922.....	35, 000
322	Mycotic Stomatitis of Cattle.....	5, 000
326	United States Grades for Timothy Hay, Clover Hay, Clover Mixed Hay, and Grass Mixed Hay.....	30, 000
	Total.....	392, 500



## NEW MISCELLANEOUS CIRCULARS

No.	Title	Copies
7	A Forest Fire Prevention Manual for the School Children of California.....	26,000
8	Demonstration Courses in Kiln Drying, Boxing and Crating, Gluing of Wood, Wood Properties and Uses.....	11,000
9	Importation and Inspection of Tea.....	3,000
10	Grain Futures Act, 1922. Rules and Regulations of the Secretary of Agriculture with Respect to Contract Markets.....	3,500
11	Agricultural Cooperations: A Selected and Annotated List.....	6,000
12	A Handbook for Better Feeding of Livestock.....	90,000
13	Local Names of Migratory Game Birds.....	11,000
14	State Sanitary Requirements Governing Admission of Livestock.....	15,000
15	Importance of Forestry and the National Forests.....	3,000
18	Instructions for Banding Birds.....	6,000
19	Forest Fires in the Intermountain Region.....	20,000
20	Crop Report Regulations.....	6,000
22	The Naval Stores Act and Regulations for its Enforcement.....	5,000
23	The Agricultural Outlook for 1924.....	125,000
24	Time-Table for Home Canning of Fruits and Vegetables.....	500,000
25	Directions for Examining All Canned Food Before Use.....	500,000
Total.....		1,330,500

## NEW STATISTICAL BULLETINS ISSUED

No.	Title	Copies
1	Cold-Storage Holdings.....	4,500
2	Seed Statistics.....	5,000
3	Sheep, Lamb, Mutton, and Wool Statistics.....	4,000
Total.....		13,500

## NEW YEARBOOK SEPARATES

No.	Title	Copies
879	The Dairy Industry.....	1 5,000
880	Imports and Exports of Agricultural Products.....	5,000
881	Statistics of Grain Crops.....	5,000
882	Hog Production and Marketing.....	8,000
883	Report of the Secretary. The Year in Agriculture.....	1,500
884	Statistics of Crops Other Than Grain Crops.....	5,000
885	History and Status of Tobacco Culture.....	8,000
886	Timber, Mine or Crop.....	40,000
887	Miscellaneous Agricultural Statistics.....	5,000
888	Livestock, 1922.....	5,000
889	Forest Statistics.....	5,000
890	Farm Operations.....	5,000
891	Oats, Barley, Rye, Rice, Grain, Sorghums, Seed Flax and Buckwheat.....	8,000
893	Sugar.....	5,000
Total.....		120,500

## NEW REPRINTS FROM JOURNAL OF AGRICULTURAL RESEARCH

Key No.	Title	Copies
A-64	Factors Which Determine Otophary in Guinea Pigs.....	1,000
A-65	A Method of Automatic Control of Low Temperatures Employed by the United States Department of Agriculture.....	1,990
A-66	Compounds Developed in Rancid Fats, with Observations on the Mechanism of Their Formation.....	1,700
A-67	A Study of the Serology, the Cerebrospinal Fluid, and the Pathological Changes in the Spinal Cord in Dourine.....	1,400
A-68	Some Factors Which Influence the Feathering of Cream in Coffee.....	1,700
A-69	The Influence of Low Temperatures and of Disinfectants on the Eggs of Ascaris Lumbricoides.....	1,476
B-18	Influence of Some Nitrogenous Fertilizers on the Development of Chlorosis in Rice.....	50
F-8	Physiological Requirements of Rocky Mountain Trees.....	1,000
F-9	Control of Snow Holding in Coniferous Nursery Stock.....	500
G-296	Occurrence and Significance of Phloem Necrosis in the Irish Potato.....	1,400
G-297	Cultivated and Wild Hosts of Sugar-Cane or Grass Mosaic.....	1,500
G-298	Species of Rhizopus Responsible for the Decay of Sweet Potatoes in the Storage House and at Different Temperatures in Infection Chambers.....	1,350
G-300	A Statistical Study of the Comparative Morphology of Biologic Forms of Puccinia Graminis.....	1,500
G-301	Relation of Certain Soil Factors to the Infection of Oats by Loose Smut.....	1,625
G-302	Influence of Temperature, Moisture, and Oxygen on the Spore Germination of Ustilago Avenae.....	1,650
G-303	Influence of Temperature on the Spore Germination of Ustilago Zeae.....	1,450
G-304	Spores in the Upper Air.....	1,500
G-305	Studies on the Life History of Stripe Rust, Puccinia Glumarum (Schm.) Erikss. & Henn.....	1,500
G-306	Some Graminicolous Species of Helminthosporium.....	1500
G-307	An Influence of Moisture on Bean Wilt.....	1,300
G-308	Further Studies on the Inheritance of "Rogue" Types in Garden Peas (Pisum sativum L.).....	1,500
G-309	A Method of Treating Maize Seed to Destroy Adherent Spores of Downy Mildew.....	1,500
G-310	Influence of the Substrate and its Hydrogenion Concentration on Pectinase Production.....	1,525
G-311	Morphology and Host Relations of Pucciniastrum Americanum.....	1,500
G-312	Watery-Rot of Tomato Fruits.....	1,350
G-315	Biologic Forms of Puccinia Graminis on Varieties of Avena Spp.....	1,600
G-316	Disease Resistance to Onion Smudge.....	1,500
G-317	Acid Production by Rhizopus Tritici in Decaying Sweet Potatoes.....	1,500

## NEW REPRINTS FROM JOURNAL OF AGRICULTURAL RESEARCH—Continued

Key No.	Title	Copies
G-319	Oxygen-Supplying Power of the Soil as Indicated by Color Changes in Alkaline Pyrogallol Solution.....	1,500
G-320	Hydrogen-Ion Changes Induced by Species of <i>Rhizopus</i> and by <i>Botrytis Cinerea</i> .....	1,500
G-321	Growth of Fruiting Parts in Cotton Plants.....	1,450
G-322	Systematic Infections of Rubus with the Orange Rusts.....	1,500
G-323	Resistance in Rye to Leaf Rust, <i>Puccinia Dispersa</i> Erikss.....	1,500
G-324	Comparative Study of Phytophthora Faberi on Coconut and Cacao in the Philippine Islands.....	1,500
G-325	Inheritance of Dwarfing in Maize	1,175
G-326	The Pharynx and Alimentary Canal of the Hookworm Larva <i>Necator Americanus</i> .....	1,400
G-327	Specialized Varieties of <i>Puccinia Glumarum</i> and Hosts for Variety <i>Tritici</i> .....	1,500
G-328	Acidity of Corn and Its Relation to Vegetative Vigor.....	1,500
G-329	A New Type of Orange-Rust on Blackberry.....	1,500
G-330	Effect of the Orange-Rusts of Rubus on the Development and Distribution of Stomata.....	1,500
G-331	Time for Testing Mother Beets.....	1,000
G-332	A Bacterial Stripe Disease of Proso Millet.....	1,200
G-333	Influence of Soil Temperature and Moisture on Infection of Wheat Seedlings by <i>Helminthosporium sativum</i> .....	1,500
G-334	Varietal Resistance in Winter Wheat to the Rosette Disease.....	1,500
G-335	Two Diseases of Udo ( <i>Aralia cordata</i> Thunb.).....	1,400
G-336	The Absorption of Carbon by the Roots of Plants.....	1,400
G-337	Bud Selection as Related to Quantity Production in the Washington Navel Orange.....	1,700
G-338	Some Physiological Variations in Strains of <i>Rhizopus Nigricans</i> .....	1,400
G-339	The Quantitative Determination of Carotin by Means of the Spectrophotometer and the Colorimeter.....	1,300
G-340	Habits of the Cotton Rootrot Fungus.....	1,500
G-341	The Red Stain in the Wood of Boxelder.....	1,500
G-342	Stem and Rootrot of Peas in the United States Caused by Species of <i>Fusarium</i> .....	1,400
G-345	Cytological Studies of Infection of Baart, Kanred, and Mindum Wheats by <i>Puccinia Graminis Tritici</i> Form III and XIX.....	1,60
G-346	The Intracellular Bodies Associated with the Rosette Disease and a Mosaiclike Leaf Mottling of Wheat.....	1,600
G-347	Physiological Studies on Apples in Storage.....	2,000
G-348	Seed-Color Inheritance in Certain Grain-Sorghum Crosses.....	1,400
G-349	Anchorage and Extent of Corn Root Systems.....	1,650
G-350	Adjusting Yields to Their Regression on a Moving Average, as a Means of Correcting for Soil Heterogeneity.....	1,500
G-351	The Effect of Rust Infection Upon the Water Requirements of Wheat.....	1,650

## NEW REPRINTS FROM JOURNAL OF AGRICULTURAL RESEARCH—Continued

Key No.	Title	Copies
G-352	Photoperiodism in Relation to Hydrogen-Ion Concentration of the Cell Sap and the Carbohydrate Content of the Plant.....	1,860
G-354	The Effect of Fertilizers on the Development of Stem Rust of Wheat.....	1,575
G-356	The Black-Bundie Disease of Corn.....	1,500
G-357	On the Anatomy of the Sweet Potato Root, with Notes on Internal Breakdown.....	1,350
G-358	Morphological and Physiological Studies on the Resistance of Wheat to <i>Puccinia Graminis tritici</i> (Erikss. and Henn.).....	1,500
G-359	Selective Fertilization in Cotton	1,300
G-360	Tissue Fluids of Egyptian and Upland Cottons and Their Hybrid.....	1,500
G-361	The Blooming of Wheat Flowers	1,200
G-364	A Bacterial Blight of Gladioli	1,350
G-366	Experiments with Flag Smut of Wheat and the Causal Fungus, <i>Urocystis tritici</i> Keke.....	1,500
G-371	Studies on the Parasitism of <i>Urocystis tritici</i> Koern., the Organism Causing Flag Smut of Wheat.....	1,500
G-374	The Movement of Water in Irrigated Soils.....	2,000
K-106	Striped Sod Webworm, <i>Crambus Mutabilis</i> Clemens.....	1,400
K-107	Silver-Striped Webworm, <i>Crambus Praefectellus</i> Sincken.....	1,400
K-108	Work and Parasitism of the Mediterranean Fruit Fly in Hawaii during 1919 and 1920.....	1,400
K-109	<i>Platygaster vernalis</i> Myers, an Important Parasite of the Hessian Fly.....	1,500
K-110	An Underscribed Orange Pest from Honduras.....	1,500
K-111	The Twinning and Monembryonic Development of <i>Platygaster hiemalis</i> , a Parasite of the Hessian Fly.....	1,500
K-112	Notes on the Biology of the Cadelle, <i>Tenebroides Mauritanicus</i> Linne.....	1,500
K-113	Biological Notes on the Termites of the Canal Zone and Adjoining Parts of the Republic of Panama.....	1,500
K-114	Oak Sapling Borer, <i>Goes Tesselatus</i> Haldeman.....	1,500
K-115	Preparation and Properties of Colloidal Arsenate of Lead.....	1,500
K-116	Our Only Common North American Chigger, Its Distribution and Nomenclature.....	1,500
K-117	The Three-Banded Grape Leafhopper and Other Leafhoppers Injuring Grapes.....	1,500
K-118	Hornworm Septicemia.....	1,500
K-119	Cutworm Septicemia.....	1,500
K-120	Biology of the False Wireworm <i>Eleodes suturalis</i> Say.....	1,500
K-121	The Eggplant Leaf-Miner, <i>Phthorimaea glochinella</i> Zeller.....	1,500
K-122	Notes on the Biology of the Four-Spotted Bean Weevil, <i>Bruchus quadrimaculatus</i> Fab.....	1,500
K-123	The Argus Tortoise Beetle.....	1,500
K-124	The European Corn Borer, <i>Pyrausta Nubilalis</i> Hbn., versus the Corn Earworm, <i>Heliothis obsoleta</i> Fab.....	1,500
K-125	Insecticidal Effect of Cold Storage on Bean Weevils.....	1,500
Wis-24	Bacterial Leafspot of Clovers.....	1,500
	Total.....	134,126

## NEW SERVICE AND REGULATORY ANNOUNCEMENTS

No.	Bureau and title	Copies
55	Bureau of Biological Survey: Migratory Bird Treaty Act and Regulations. (As Amended July 11, 1923.)	10,000
56	Protection of Land Fur-bearing Animals in Alaska.	5,500
57	Cold Springs Reservation, Oregon.	1,000
58	The Use of Headlights on Big Lake Reservations Prohibited.	1,000
59	Regulations for the Protection of Game in Certain Localities in Alaska.	5,000
60	Regulations for the Protection of Land Fur-bearing Animals in Alaska.	5,000
	Federal Horticultural Board: Nos. 74 to 77, inclusive (total).	14,000
75	Bureau of Agricultural Economics: United States Officials for Grades of Wool.	7,000
76	Regulations of the Secretary of Agriculture Under the United States Warehouse Act, August 11, 1916.	7,000
77	Rules and Regulations of the Secretary of Agriculture, Governing the Inspection of Hay.	3,500
78	Rules and Regulations of the Secretary of Agriculture, Governing the Inspection and Certification of Fruits, Vegetables, and Other Products.	11,000
79	Rules and Regulations Governing the Inspection and Certification of Butter, Cheese, and Eggs.	4,000
80	Regulations of the Secretary of Agriculture under the United States Cotton Standards Act.	10,000
81	Regulations of the Secretary of Agriculture under the United States Warehouse Act. Regulations for Peanut Warehouses.	3,000
82	The United States Cotton Standards Act and the Universal Standards.	10,000
83	Regulations for Potato Warehouses.	5,000
	Bureau of Animal Industry: Nos. 194 to 204, inclusive (total).	88,000
	Index to S. R. A. for 1923.	6,500
	Bureau of Chemistry: Nos. 158 to 171, inclusive (total).	85,000
45	Insecticide and Fungicide Board: N. J. 851 to 855.	5,000
46	N. J. 876 to 900.	5,000
7	Bureau of Plant Industry: Adulteration and Misbranding of the Seeds of Orchard Grass and Hairy Vetch.	5,000
	Total.	296,500

## ANNUAL REPORTS OF SECRETARY AND BUREAU CHIEFS FOR 1923—Continued

Bureau or office	Copies
Federal Horticultural Board.	2,500
Fixed Nitrogen Research Laboratory.	2,500
Forest Service.	2,500
Insecticide and Fungicide Board.	1,500
Administration of Grain Futures Act.	1,000
Library.	750
Packers and Stockyards Administration.	1,000
Bureau of Plant Industry.	2,500
Division of Publications.	1,000
Bureau of Public Roads.	1,500
Bureau of Soils.	500
Solicitor.	1,000
States Relations Service.	2,000
Weather Bureau.	500
Total.	42,950

## NEW SOIL SURVEYS RECEIVED

County and State	Copies
Geneva County, Ala.	1,050
Marengo County, Ala.	1,000
Winslow Area, Ariz.	1,000
Perry County, Ark.	1,000
Brawley Area, Calif.	1,000
Shasta Valley Area, Calif.	1,000
Duval County, Fla.	1,000
Carroll County, Ga.	1,000
Rockdale County, Ga.	1,000
Emmet County, Iowa.	1,000
Dickinson County, Iowa.	1,000
Dubuque County, Iowa.	1,000
Hardin County, Iowa.	1,000
Woodbury County, Iowa.	1,000
Muhlenberg County, Ky.	1,000
Ontonagon County, Mich.	1,000
St. Joseph County, Mich.	1,000
Smith County, Miss.	1,000
Lafayette County, Mo.	1,000
St. Louis County, Mo.	1,000
Howard County, Nebr.	1,000
Bernardsville Area, N. J.	1,000
Chatsworth Area, N. J.	1,000
Wayne County, N. Y.	1,000
Buncombe County, N. C.	1,000
Onslow County, N. C.	1,000
Tyrrell County, N. C.	1,000
Josephine County, Ore.	1,000
Greenville County, S. C.	1,000
Dallas County, Tex.	1,000
Erath County, Tex.	1,000
Tarrant County, Tex.	1,000
Ashley Valley, Utah.	1,000
Adams County, Wis.	1,000
Total.	34,000

## NEW POSTERS ISSUED

Title	Copies
Why Purebreds Excel.	12,000
Purebred Sires Used Exclusively on this Farm.	10,000
Ten Points in Better Feeding.	10,000
Foot-and-Mouth Disease.	5,000
Open Seasons for Game. 1923-24.	11,500
Rodents in Wyoming.	5,000
Vandals of the Night.	10,000
Open Seasons for Game. 1924-25.	16,500
The Japanese Beetle.	2,000
Food Charts (15 in set).	100
Calorie Portions of a Few Familiar Foods.	1,500
Total.	93,600

## ANNUAL REPORTS OF SECRETARY AND BUREAU CHIEFS FOR 1923

Bureau or office	Copies
Report of Secretary of Agriculture.	9,800
Reports of the Department of Agriculture.	400
Division of Accounts and Disbursements.	500
Bureau of Agricultural Economics.	2,500
Bureau of Animal Industry.	2,500
Bureau of Biological Survey.	2,500
Bureau of Chemistry.	2,500
Bureau of Entomology.	1,500







# REPORT OF THE CHIEF OF THE BUREAU OF PUBLIC ROADS

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF PUBLIC ROADS,  
*Washington, D. C., October 15, 1924.*

SIR: I have the honor to submit herewith the report of the Bureau of Public Roads for the fiscal year ended June 30, 1924, covering especially those functions of the bureau which are provided for by the act making appropriations for the Department of Agriculture. A brief statement of the work done in connection with the construction of Federal-aid and national-forest roads is also included, but a more complete report of that work will be made in a subsequent report as provided for in section 19 of the Federal highway act, approved November 9, 1921.

Respectfully,

THOS. H. MACDONALD,  
*Chief of Bureau.*

HON. HENRY C. WALLACE,  
*Secretary of Agriculture.*

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## FEDERAL-AID ROAD CONSTRUCTION

A detailed report of the operations of the bureau in connection with the construction of Federal-aid roads is furnished separately for inclusion in the report to Congress which the Secretary is required to make annually by the Federal highway act. In this report, therefore, it is believed that such detailed information may be omitted, but it will not be inappropriate, perhaps, to review in a general way the progress that has been made, and to refer to a few of the more significant accomplishments of the year.

It is not difficult this year to single out the most important forward step. The final designation and approval of the Federal-aid highway system in all the States of the Union is an event that will be recognized as time goes on as one of the milestones of progress in the improvement of the highways of the country. The map of the system, published November 1, 1923, presents a definite plan for the improvement of

the main highways of the Nation—a plan which it is possible to carry out in a period of not more than 10 years, and which, in that limited period, will result in a connected system of arterial highways that will permit unobstructed highway transportation between all cities of 5,000 population or larger. The duty of constructing the connecting roads which are needed to give access to the main system rests with the States and counties.

The Federal highway act of November 9, 1921, which provided for the designation of the system, also provided that within two years a map should be published showing the progress of selection and designation of the system. The map published within the time limit specified represents the required system practically in its entirety. The determination of the mileage of the system, as prescribed by law, was based on the mileage of all existing roads of record in the several State highway departments at the



time of the passage of the act. Each State was asked to certify the mileage of its existing roads according to its records, and the total of certifications amounted to 2,866,061 miles, 7 per cent of which, or 200,624 miles, the law provides may be included in the Federal-aid highway system.

The map issued in November includes 168,881 miles. Subsequently additions were made in several States which increase the total as of June 30, the end of the fiscal year, to 171,687 miles. The original map represents the system of the entire United States on a scale of 1 to 5,000,000. A relatively small edition of it was published for the use of the several State departments and various agencies of the Federal Government. Subsequently, in order to make available a map suitable for more general use, a set of maps consisting of 18 sheets, each sheet comprising a group of States, was published.

#### ORIGINAL SYSTEM COMPLETED IN THREE STATES

In designating the system in the several States the most important interstate and intercounty roads have been included up to the limit of mileage prescribed by the law, without regard to their state of improvement. A considerable mileage has been included which is already improved, and the magnitude of the task ahead is reduced to that extent.

In three States the original system has already been completed or provided for and, as contemplated by the law, additions to the system in excess of 7 per cent of the total mileage of public highways have been approved by the Secretary as State funds have become available for such extensions. These States are Delaware, Maryland, and Rhode Island. In Delaware the original system, comprising the full 7 per cent of existing total mileage, included 266.84 miles. Completion of this system was recognized by the Secretary on July 17, 1923, at which time the first extensions were approved. In Maryland the original system comprised 1,036.7 miles, and this mileage was completed or provided for and so recognized by the Secretary August 23, 1923, at which time additions were approved. The Rhode Island system of 165.95 miles was reported complete in June, 1924, and acceptance of the system was pending at the close of the fiscal year.

In connection with the completion of the original system in these States

it was necessary to consider the condition not only of the Federal-aid projects constructed on the approved system but also all other construction by the State or its political subdivisions. Anticipating the completion of the system in other States, most of which have a much larger mileage, a detailed examination of all roads in the systems of the several States is now under way. The results of the examination are recorded and constitute a complete description of the condition of the entire system. Such descriptions had been completed prior to the close of the fiscal year in Connecticut and Pennsylvania, and were nearly completed in New Jersey. These records will ultimately show in detail the condition of improvement of the entire Federal-aid system, and the work of compiling them will be advanced as rapidly as the administration of the Federal highway act requires.

As this information is secured it is recorded on road maps of the States on a scale sufficiently large to show the improved sections and the nature of each. These maps, together with written descriptions of each improved section, will furnish the most complete collection of road information that has ever been undertaken.

#### THE IMPROVEMENT OF THROUGH ROADS IN THE WEST

The survey of the status of improvement in the Western States indicates that the part of the system in the 11 Pacific and Mountain States, embracing 31,437 miles, is now more than 50 per cent completed. In these States attention has been given especially to the acceleration of the improvement of through roads to the coast, particularly in Nevada and Utah toward San Francisco. In these States the national need for through east-and-west connection does not in all cases coincide with the highway needs of the locality. This is a situation which is peculiar to the sparsely settled Western States. Elsewhere it is found that the national and local needs are practically identical.

An extensive investigation of various possible routes across the Mohave Desert in California, Nevada, and Arizona has resulted in the selection of routes which will shorten the line of transcontinental travel by 37 miles. A similar study of the route from Salt Lake City to Los Angeles has made possible a reduction in mileage of 88 miles, and it has been found

to be possible to combine these two routes for 103 miles, thus reducing correspondingly the necessary Federal-aid mileage.

### PROGRESS OF CONSTRUCTION

As the result of the year's work 8,620 miles have been added to the mileage of completed roads, bringing the total completed since 1916, when the policy of Federal aid was initiated, to 35,157 miles. Work was in

progress at the end of the year on 15,350 miles, and these roads were reported as 56 per cent complete in the aggregate.

The total cost of the roads completed during the year was \$144,707,337.26, of which \$66,789,426.70 was paid by the Federal Government. The total expenditure of Federal-aid funds during the year, including payments made on the completed roads and progress payments on the roads remaining under construction, was \$79,217,397.90.

*Mileage, total cost, and Federal aid allotted to all Federal-aid roads completed up to June 30, 1924, by States*

State	Total cost <sup>1</sup>	Federal aid <sup>1</sup>	Miles
Alabama.....	\$7,517,652.60	\$3,645,712.99	671.5
Arizona.....	8,464,741.67	4,364,912.41	537.7
Arkansas.....	11,168,854.55	4,459,345.63	948.9
California.....	17,129,807.90	7,860,406.87	681.4
Colorado.....	9,624,118.34	4,875,189.66	578.3
Connecticut.....	3,411,625.09	1,433,498.60	81.8
Delaware.....	3,479,251.47	1,188,737.33	84.3
Florida.....	2,959,921.69	1,432,297.39	112.6
Georgia.....	18,255,751.55	8,485,801.41	1,326.8
Idaho.....	8,412,287.56	4,233,045.90	526.8
Illinois.....	30,529,027.07	14,059,816.59	914.2
Indiana.....	8,851,308.28	4,288,205.02	263.2
Iowa.....	23,392,465.64	9,323,231.86	1,688.6
Kansas.....	22,157,546.12	7,727,772.68	657.5
Kentucky.....	11,240,254.38	4,826,886.37	452.9
Louisiana.....	8,854,764.36	3,801,223.09	701.1
Maine.....	7,028,584.03	3,358,698.00	237.0
Maryland.....	7,001,602.09	3,332,677.06	252.7
Massachusetts.....	11,218,868.20	4,490,689.22	254.4
Michigan.....	15,651,440.84	7,167,293.78	573.9
Minnesota.....	23,990,791.09	9,889,836.27	2,310.2
Mississippi.....	7,888,193.89	3,828,845.32	655.0
Missouri.....	12,712,501.43	5,926,010.43	906.1
Montana.....	8,911,059.55	4,408,281.04	805.7
Nebraska.....	10,310,188.74	4,909,514.60	1,718.9
Nevada.....	3,946,723.21	2,324,136.18	282.5
New Hampshire.....	3,228,323.59	1,554,076.35	176.2
New Jersey.....	8,266,033.22	2,872,160.02	159.2
New Mexico.....	6,708,414.96	3,602,488.73	879.6
New York.....	21,514,710.61	9,286,615.78	627.6
North Carolina.....	16,828,430.45	7,245,122.17	1,005.1
North Dakota.....	9,177,593.39	4,464,647.10	1,634.2
Ohio.....	33,856,447.68	12,110,970.93	984.8
Oklahoma.....	12,986,865.26	5,888,852.03	497.3
Oregon.....	12,378,149.70	5,999,884.29	676.2
Pennsylvania.....	42,432,577.89	16,096,142.29	831.0
Rhode Island.....	1,952,590.40	841,827.96	49.1
South Carolina.....	9,278,992.55	4,315,610.91	1,035.6
South Dakota.....	9,471,954.54	4,703,417.22	1,096.6
Tennessee.....	7,578,569.06	3,700,378.92	292.1
Texas.....	42,511,071.15	16,242,423.41	3,161.5
Utah.....	4,181,049.06	2,403,576.97	317.5
Vermont.....	1,922,114.16	942,769.12	74.4
Virginia.....	11,295,753.95	5,390,201.02	620.8
Washington.....	11,192,478.17	5,231,713.29	469.2
West Virginia.....	6,171,851.10	2,663,341.02	275.8
Wisconsin.....	19,078,289.18	7,605,283.33	1,356.8
Wyoming.....	6,224,847.80	3,152,141.34	712.3
Total.....	602,326,389.21	261,955,709.90	35,156.9

<sup>1</sup> Figures subject to revision on payment of a few final vouchers now outstanding.

*Mileage, total cost, and Federal aid allotted to Federal-aid roads completed during the fiscal year 1924, by States*

State	Total cost <sup>1</sup>	Federal aid <sup>1</sup>	Miles
Alabama.....	\$3,498,331.31	\$1,735,855.02	281.6
Arizona.....	1,867,550.18	1,120,842.26	161.1
Arkansas.....	1,710,491.98	754,273.51	120.7
California.....	5,966,694.48	2,961,544.12	236.1
Colorado.....	2,426,060.84	1,340,102.69	119.9
Connecticut.....	637,077.64	329,349.75	17.2
Delaware.....	882,552.75	404,957.50	26.6
Florida.....	1,835,869.96	889,031.97	54.1
Georgia.....	3,385,611.08	1,670,211.85	313.4
Idaho.....	1,531,613.83	960,934.89	100.7
Illinois.....	5,283,778.96	2,628,663.69	169.4
Indiana.....	2,429,554.75	1,170,062.58	83.6
Iowa.....	6,708,418.12	2,976,930.45	498.3
Kansas.....	2,814,977.98	2,221,652.64	197.0
Kentucky.....	4,091,665.45	1,772,755.66	149.8
Louisiana.....	774,581.92	354,427.71	51.2
Maine.....	1,901,381.81	891,784.33	77.0
Maryland.....	1,486,580.88	709,254.92	60.6
Massachusetts.....	3,290,325.72	1,221,644.39	64.5
Michigan.....	4,327,152.21	1,957,761.76	151.5
Minnesota.....	3,614,442.16	1,612,349.17	379.6
Mississippi.....	2,119,022.64	1,043,974.35	144.3
Missouri.....	4,036,079.66	2,002,794.21	357.0
Montana.....	678,175.29	357,753.90	63.9
Nebraska.....	2,578,227.83	1,136,018.65	337.8
Nevada.....	490,595.18	474,163.13	51.7
New Hampshire.....	804,712.87	391,342.72	34.5
New Jersey.....	2,257,014.09	709,736.50	57.8
New Mexico.....	1,449,383.46	861,822.67	179.0
New York.....	9,357,341.72	4,038,673.77	291.0
North Carolina.....	3,914,317.99	1,479,048.51	110.2
North Dakota.....	3,201,497.94	1,562,676.03	668.2
Ohio.....	8,972,108.94	3,473,067.42	267.7
Oklahoma.....	2,610,121.38	1,178,008.92	123.8
Oregon.....	1,830,105.86	1,121,358.05	132.4
Pennsylvania.....	9,165,681.09	3,396,083.50	174.0
Rhode Island.....	468,485.05	194,193.00	10.5
South Carolina.....	2,799,080.27	1,280,643.13	320.6
South Dakota.....	3,399,339.49	1,726,556.03	417.4
Tennessee.....	2,101,606.26	1,031,620.82	85.2
Texas.....	9,488,741.88	3,558,051.67	641.2
Utah.....	1,482,812.55	869,250.45	139.9
Vermont.....	551,398.53	273,335.37	21.3
Virginia.....	3,234,876.38	1,496,941.16	163.9
Washington.....	835,497.35	412,607.59	49.4
West Virginia.....	1,636,124.52	651,078.19	52.0
Wisconsin.....	3,492,543.18	1,569,794.09	265.8
Wyoming.....	1,287,731.85	764,442.01	165.9
Total.....	144,707,337.26	66,789,426.70	8,620.3

<sup>1</sup> Figures subject to revision on payment of a few final vouchers now outstanding.

As in previous years, the mileage of gravel roads completed exceeded the mileage of any other type of construction, the year's total including 3,353.8 miles. Other types were completed, as follows: Graded and drained, 1,604.8 miles; sand-clay, 888.2 miles; water-bound macadam, 106.7 miles; bituminous macadam, 566.6 miles; bituminous concrete, 252.1 miles; concrete,

1,667.9 miles; brick, 169.4 miles. Bridges more than 20 feet in span completed during the year aggregated in length 10.8 miles. The mileage of the various types completed during the year and since the initiation of the Federal-aid policy and the mileage by types and by States are shown in the accompanying tables.



*Mileage of all Federal-aid roads completed up to June 30, 1924, by types of construction and by States*

States	Graded and drained	Sand-clay	Gravel	Water-bound macadam	Bituminous macadam	Bituminous concrete	Portland cement concrete	Brick	Bridges	Total
Alabama	3.2	286.7	277.7	11.6	26.6	54.8	9.6	-----	1.3	671.5
Arizona	52.7	55.9	312.6	14.2	-----	9.0	92.3	-----	1.2	537.7
Arkansas	-----	-----	660.0	44.8	29.5	176.4	37.2	-----	1.1	948.9
California	218.8	-----	102.7	7.3	45.6	26.5	279.6	-----	1.0	681.4
Colorado	150.5	67.4	240.8	-----	-----	1.0	116.3	-----	2.2	578.3
Connecticut	-----	-----	-----	-----	27.1	-----	54.7	-----	-----	81.8
Delaware	-----	-----	-----	-----	-----	-----	78.1	6.2	-----	84.3
Florida	-----	21.2	-----	-----	42.1	8.6	30.6	10.1	0.1	112.6
Georgia	58.3	836.9	209.9	22.2	69.8	11.6	103.4	0.3	14.6	1,326.8
Idaho	111.4	18.6	337.5	4.3	-----	33.0	21.3	-----	0.9	526.8
Illinois	135.1	-----	0.4	-----	3.3	8.1	748.7	17.3	1.2	914.2
Indiana	0.5	-----	12.4	-----	-----	12.0	238.0	-----	0.4	263.2
Iowa	1,014.4	-----	344.4	-----	-----	-----	307.9	22.0	-----	1,688.6
Kansas	97.1	16.8	109.8	4.5	28.5	-----	305.1	95.6	-----	637.5
Kentucky	244.6	-----	41.8	38.4	82.0	-----	42.0	3.9	0.2	452.9
Louisiana	7.4	-----	683.0	3.2	-----	7.6	-----	-----	-----	701.1
Maine	-----	-----	101.4	-----	95.1	-----	39.3	-----	0.2	237.0
Maryland	3.8	-----	28.9	0.1	27.3	12.3	180.4	-----	-----	252.7
Massachusetts	-----	-----	-----	3.3	141.0	25.0	84.6	-----	0.5	254.4
Michigan	-----	-----	224.8	18.9	-----	61.5	268.3	-----	-----	573.9
Minnesota	221.0	-----	1,855.9	-----	-----	22.1	210.8	-----	0.3	2,310.2
Mississippi	121.4	14.4	443.5	11.1	-----	3.4	52.0	9.2	-----	655.0
Missouri	202.1	-----	518.9	8.2	38.9	2.8	127.9	5.7	1.5	906.1
Montana	193.2	-----	555.9	16.0	6.9	0.9	31.3	-----	1.6	805.7
Nebraska	1,320.8	163.1	181.5	-----	-----	6.7	34.7	11.9	-----	1,718.9
Nevada	69.9	7.0	153.3	-----	15.6	1.6	34.6	-----	0.5	282.5
New Hampshire	-----	-----	86.6	23.1	35.9	27.7	1.9	-----	1.0	176.2
New Jersey	-----	-----	3.4	-----	-----	5.0	150.8	-----	-----	159.2
New Mexico	191.6	5.1	638.3	-----	-----	0.7	43.2	-----	0.8	879.6
New York	-----	-----	-----	-----	217.5	-----	407.9	0.7	1.5	627.6
North Carolina	66.3	598.0	85.8	17.8	33.0	93.4	109.4	-----	1.4	1,005.1
North Dakota	1,322.2	6.5	300.3	-----	-----	0.7	3.0	-----	1.4	1,634.2
Ohio	25.0	-----	-----	82.6	204.8	84.7	292.1	295.6	0.1	984.8
Oklahoma	28.3	2.3	279.6	6.3	0.6	45.0	128.9	1.2	5.2	497.3
Oregon	96.6	-----	433.6	25.6	-----	52.9	66.8	-----	0.7	676.2
Pennsylvania	-----	-----	-----	-----	7.8	99.7	698.7	24.8	-----	831.0
Rhode Island	-----	-----	-----	-----	10.5	31.5	7.1	-----	-----	49.1
South Carolina	-----	875.2	94.0	-----	3.0	22.1	38.6	0.2	2.4	1,035.6
South Dakota	195.6	-----	899.4	-----	-----	-----	0.8	-----	0.7	1,096.6
Tennessee	3.3	-----	61.3	50.6	147.1	7.4	21.9	-----	0.5	292.1
Texas	163.8	58.1	2,190.3	362.1	111.2	49.8	196.1	20.8	4.1	3,161.5
Utah	114.9	-----	132.1	9.3	-----	7.8	53.0	-----	0.5	317.5
Vermont	-----	-----	51.3	1.4	17.9	-----	3.5	-----	0.3	74.4
Virginia	18.0	179.0	71.1	108.5	106.0	3.3	134.3	-----	0.7	620.8
Washington	28.1	-----	262.3	-----	-----	-----	177.4	-----	1.4	469.2
West Virginia	106.1	1.7	18.2	4.9	67.1	11.4	54.7	11.4	0.2	275.8
Wisconsin	233.6	140.5	673.8	2.7	9.6	-----	296.5	-----	0.1	1,356.8
Wyoming	190.6	373.1	132.5	-----	-----	1.2	12.9	-----	2.0	712.3
Total	7,015.1	3,727.5	13,810.9	903.0	1,652.3	1,029.2	6,428.2	536.9	53.8	35,156.9

*Mileage of Federal-aid roads completed during the fiscal year 1924, by types of construction and by States*

States	Graded and drained	Sand-clay	Gravel	Water-bound macadam	Bituminous macadam	Bituminous concrete	Portland cement concrete	Brick	Bridges	Total
Alabama.....		78.1	149.8		17.4	31.2	4.8		0.2	281.6
Arizona.....	16.0	37.8	85.2			4.0	17.8		0.4	161.1
Arkansas.....			81.1	4.5	8.3	10.6	15.9		0.3	120.7
California.....	71.0		86.6	7.3	14.8	5.1	51.4			236.1
Colorado.....	12.5		63.5			1.0	42.4		0.5	119.9
Connecticut.....							17.3			17.3
Delaware.....							26.6			26.6
Florida.....					20.6	8.6	21.1	3.8	0.1	54.1
Georgia.....		152.7	100.3	4.5	20.8	9.1	25.5		0.6	313.4
Idaho.....	2.3		78.9			6.8	12.8		0.1	100.7
Illinois.....	0.2						168.2		0.9	169.4
Indiana.....	0.5		12.4				70.4		0.3	83.6
Iowa.....	269.0		108.2				121.1			498.3
Kansas.....	37.5	16.8	20.1		8.7		95.7	18.1		197.0
Kentucky.....	89.0		2.9		41.1		16.8		0.1	149.8
Louisiana.....			49.3			1.9				51.2
Maine.....			48.0		12.1		16.8			77.0
Maryland.....	1.0		5.0			6.5	48.2			60.6
Massachusetts.....					42.1		22.2		0.3	64.5
Michigan.....			40.7	8.9		9.3	92.5			151.5
Minnesota.....	81.2		291.2				6.9		0.2	379.6
Mississippi.....		14.4	93.5	11.1		3.4	19.0	2.8		144.3
Missouri.....	104.5		236.6	1-28.7	18.0		25.6		0.8	357.0
Montana.....	25.6		33.5				4.8		0.1	63.9
Nebraska.....	144.2	100.9	57.1			6.7	24.4	4.4		337.8
Nevada.....	13.5		24.7	1-3.5	15.6		1.2		0.1	51.7
New Hampshire.....			8.3	5.2	14.5	3.7	1.9		0.8	34.5
New Jersey.....							37.8			37.8
New Mexico.....	42.6		129.0			0.7	6.8			179.0
New York.....					119.2		169.6	0.7	1.4	291.0
North Carolina.....	3.1	4.5		14.3	1-5.0	24.4	68.8		0.1	110.2
North Dakota.....	497.9	1.5	167.8			1-0.4	1.1		0.3	668.2
Ohio.....	13.5			5.6	33.7		26.6	119.4		267.7
Oklahoma.....	0.9	0.3	82.6	6.3		18.2	15.0		0.7	123.8
Oregon.....			110.7			12.3	9.0		0.4	132.4
Pennsylvania.....					0.3	14.5	158.1	1.1		174.0
Rhode Island.....					1.8	3.9	4.8			10.5
South Carolina.....		292.6	21.5			2.8	3.7		1-0.2	320.6
South Dakota.....	42.2		374.2				0.8		0.2	417.4
Tennessee.....	3.3			19.3	62.5					85.2
Texas.....	32.2		429.9	34.5	61.6	40.9	21.9	19.2	0.7	641.2
Utah.....	39.1		89.3				11.0		0.5	139.9
Vermont.....			15.6		5.4				0.2	21.3
Virginia.....	12.0	48.6		17.1	28.6		57.2		0.3	163.9
Washington.....	1.6		42.9				4.6		0.4	49.4
West Virginia.....	10.2		7.1		24.3		10.2			52.0
Wisconsin.....	24.2	18.9	175.4				47.4			265.8
Wyoming.....	14.3	121.0	30.9						1-0.2	165.9
Total.....	1,604.8	888.2	3,353.8	106.7	566.6	252.1	1,667.9	169.4	10.8	8620.3

<sup>1</sup> Negative figures caused by revision of records when final vouchers were paid on projects the type of which was changed after ratification of project agreement.

The wisdom of the stage-construction policy which has been followed in the approval of gravel and other low-type surfacing materials for a large percentage of the total improved mileage has been definitely proved by experiments conducted by the Iowa State College. These experiments show that the tractive resistance of well-maintained gravel surfaces is only slightly greater than that of the highest types of paved roads. The cost of vehicular operation over such roads is therefore not greatly in excess of the minimum attainable by paving. The original cost is much lower, and so long

as the traffic does not exceed in volume or weight the limits within which these lower types are economically maintainable, the experiments indicate that the investment in them is a good one. Other experiments show that the low-type surfaces make the best possible bases for pavements when the traffic reaches proportions which justify paving.

#### IMPORTANT BRIDGES BUILT WITH FEDERAL AID

One of the most helpful results of Federal aid to road construction has been the bridging of major streams

which it has encouraged and made possible. Such streams are, in many cases, the boundaries of counties or States, and the necessity of securing joint action of the authorities of the two political divisions, coupled with the inadequacy of funds available, has made the construction of modern structures over wide rivers an almost hopeless problem. Yet it is evident that no continuous road system is possible without bridging these barriers.

Federal aid and the coordinating influence of the Federal Government have been the means of securing practical action in a great many cases of this sort. The careful study of the principal lines of travel leading to the designation of the Federal-aid highway system has developed clearly the need of bridges of this character over certain streams and has brought about agreement as to the locations in which the bridges should be built. This benefit has been experienced by the majority of the States, especially those of the South and the Mississippi Valley.

#### RAILROAD GRADE CROSSING ELIMINATION

In connection with the designation of the Federal-aid highway system and the approval of projects for construction it has been possible to foresee some of the possibilities of railroad grade-crossing elimination. The development of automobile traffic and the statistics of grade-crossing accidents give the fullest possible justification to any reasonable action which will reduce the hazards to both railway and highway traffic at such points.

Studies of the railroad and highway intersections have already been completed in several States, and so far as possible the various grade crossings have been classified according to the degree of danger existing.

The results so far accomplished in the elimination of grade crossings are very gratifying. The State highway departments and the bureau have been able to secure the elimination of 26 per cent of the grade crossings existing in projects submitted to the bureau for approval. Of the total number of crossings eliminated, 65 per cent were removed by relocation of the road and the remainder by suitable overhead structures or underpasses. In a great many cases the grade crossings which remain in a project are branch-line railroads or industrial roads carrying very few trains and, therefore, not warranting at this time the usual heavy costs of

elimination. The disposal of 26 per cent of the grade crossings represents, therefore, the elimination of a much larger percentage of the hazard, because elimination is confined more or less to the most dangerous intersections.

#### FOREST HIGHWAY IMPROVEMENT

In compliance with the Federal highway act of November 9, 1921, forest highway systems have been selected in Alaska and all except three of the Western States in which there are national forests. Negotiations are still under way in California, Oregon, and New Mexico, and it is hoped that a satisfactory agreement can be reached in the near future with respect to the systems of these States.

The forest highway systems, which have been selected by conference between representatives of the State highway departments, the Bureau of Public Roads, and the Forest Service, are composed of three classes of roads, as follows:

- (1) All existing and proposed roads or parts of roads, which are necessary sections or extensions of the Federal-aid system wholly within the national forests.

- (2) Other existing and proposed roads or parts of roads, which are extensions of the Federal-aid system and partly within or adjacent to and serving the national forests, and which may be designated as forest roads by the Forester and the Chief of the Bureau of Public Roads.

- (3) Other existing or proposed forest roads of primary importance to counties or communities.

Present indications are that the forest highway system when completed will include approximately 775 miles of class 1 road, between 6,000 and 7,000 of class 2 road, and between 4,000 and 5,000 of class 3 road, or in the neighborhood of 12,000 miles of forest highways. All future forest highway appropriations must be expended on this system when finally approved. The selection of the forest highway system has required a large number of detailed field inspections in order to determine the fitness of the various classes of forest highways to form a part of the proposed system.

Up to the close of the fiscal year 1,823 miles of forest roads had been completed, the construction of which represented an expenditure equivalent to \$18,228,304.52. This amount does not include the costs of administration, surveys, and plans, but does in-



clude an allowance for the Government-owned material and equipment used in the construction. These are charged at slightly less than the current market rates.

The roads completed during the year amount to 286 miles, their total cost on the basis described above being \$4,166,861.79. In addition there were under construction at the end of the year 1,042.5 miles, which it is estimated will cost in excess of \$16,000,000. The expenditure on these projects up to the close of the year amounted to \$8,308,104.44.

Work on the various projects has progressed satisfactorily, and it is expected that the mileage of completed road will be considerably increased by the completion of a number of projects which are now in the final stages of construction. In many sections the season for forest highway work is short. On this account it is desirable that contracts be let as early as possible in the season, and efforts have been made to do so. In some cases, however, the difficulty of negotiating agreements with local authorities has delayed the work.

Traffic has increased on many of the forest highways to a point where it has become necessary to widen some of the earlier projects. It has also been found desirable to surface many of the projects previously constructed, and present plans provide for surfacing, except on those projects where the natural soil is of such a nature that it will carry the traffic without additional surfacing. A considerable improvement has been made in standards, and the roads being constructed as forest highways compare favorably with the roads constructed as Federal-aid highways. It is our endeavor wherever possible to keep the standard of the forest highways equal to those of adjacent State and Federal-aid highways. In the matter of structures, while every attempt has been made to utilize to the fullest extent the local materials available, permanent structures have been built as far as possible.

The bureau has undertaken the maintenance of all forest highway projects for the first two years after their completion. After this period the local cooperator assumes the responsibility and expense of maintenance. The most critical time for maintenance is the first two years after construction, and it has been found desirable for the bureau to handle the maintenance work on the project during this period. At the end of this time sliding of the banks has usu-

ally ceased and the surface has been put in a fairly good condition to withstand traffic.

### SURPLUS WAR MATERIALS

The distribution of surplus war materials has dropped in quantity to just about the point of minimum economic operation. The following tabulation shows the class of material being distributed:

#### *Surplus war material shipped during the fiscal year 1924*

Item	Number	Value
Motor vehicles.....	860	\$1,693,847.40
Tractors.....	125	530,208.94
Steel buildings.....	24	132,700.00
Automobile spare parts.....		1,568,741.00
Tractor spare parts.....		654,183.00
Engineer and shop tools.....		433,900.40
Shop machinery.....		1,007,186.40
Road machinery.....		86,048.70
Rail and structural steel.....		135,792.84
Explosives.....		3,412,820.43
Miscellaneous road-building material.....		2,616,104.04
Total.....		12,271,533.15

Of the total volume of material distributed, valued at \$12,271,533.15, a part, valued at \$8,978,412.23, was distributed to State highway departments, \$748,910.12 in value to United States Government departments, and \$2,544,210.80 was the value of the explosives shipped to farmers for land-clearing purposes.

The type of material distributed has changed somewhat. The item of motor vehicles, which was the first and biggest single item of war surplus to be distributed and which, up until this year, constituted over 40 per cent in value of the total distribution, has dropped to a relatively small quantity, and during the past year constituted only about 14 per cent in value of the total distributions.

The high percentage of general miscellaneous material has also been lessened, and the greater part of the material now being shipped, as will be seen from the tabulation, consists of shop machinery, road machinery, automobile spare parts, tractors, tractor parts, engineer and shop tools, and explosives.

The two items of shop machinery and explosives have become increasingly important. The total percentage of shop machinery previous to this year was only 2 per cent of the total material shipped. During the past

year the shop machinery shipped amounted to 8 per cent of the total. The percentage of explosives previous to this year was slightly less than 3 per cent of the total material shipped. During the past year the explosives shipped amounted to 28 per cent in value of the total material shipped.

The quantity of explosives shipped during the ensuing year will be still higher. The sodium picrate and the sodatol distributions have been practically completed. Recently, however, a contract has been let for the mixing and cartridging of another explosive, known as pyrotol, which is now available, and from present indications, it will have a still larger distribution than any explosive previously shipped by the Department of Agriculture. The total amount available under the contract is approximately 60,000,000 pounds, representing a value of about \$9,000,000.

The total value of surplus war material distributed up to the end of the fiscal year is \$241,067,370.65. The class of material distributed is shown in the accompanying table.

*Total value of all surplus war material shipped up to the end of the fiscal year 1924*

Item	Number	Value
Motor vehicles.....	35,395	\$96,790,449.40
Tractors.....	2,441	14,441,277.94
Steel buildings.....	24	132,700.00
Automobile spare parts.....		23,452,767.00
Tractor spare parts.....		1,494,053.00
Engineer and shop tools.....		3,084,973.40
Shop machinery.....		6,000,424.40
Road machinery.....		86,048.70
Rail and structural steel.....		2,109,295.84
Hospital supplies.....		2,366,134.00
Explosives.....		10,090,338.43
Miscellaneous road-building supplies.....		81,018,908.54
Total.....		241,067,370.65

The estimated sales value of the above material, at the low prices which the War Department has commonly received for property so sold, would have been somewhere between \$20,000,000 and \$30,000,000. The net gain to the taxpayers of the United States is something over \$210,000,000.

## IMPORTANCE OF HIGHWAY RESEARCH

For several years the reports of the bureau have referred to the various researches which have been undertaken in the physical and economic fields. We have regarded these in-

vestigations as a duty and have looked upon them as no less important than the work of construction represented by the Federal-aid activities. It has been felt that they were imperatively needed, in fact, to insure the successful administration of the construction work.

A number of investigations of the most fundamental character have been under way for several years. Because of their importance it has been felt that they should be conducted in the most thorough manner possible, and the great amount of detail involved in such a treatment has made it impossible to present definite conclusions. After several years of intensive work we are now reaching the point where the several lines of investigation are beginning to produce definite results, and the practical value of these results is most gratifying.

Realizing that road improvement is justifiable only if it facilitates or reduces the cost of necessary and legitimate highway transportation we have been endeavoring to establish the factual basis for a scientific and businesslike administration of highway improvement. As a result of the investigations of the bureau and of other agencies, a number of which have worked in direct cooperation, facts are now being brought to light which, considered in relation to each other, do indicate the general outlines of a scientific method which will practically eliminate guesswork, waste, and uneconomical practices.

To indicate the practical character of the results of the investigations it may be appropriate to refer to a number of phases of the road problems, the treatment of which rested formerly largely upon individual opinion or belief, which are now dealt with in a scientific manner. In the first place, it is no longer necessary that there shall be any doubt as to the necessity or economy of any particular road improvement. Methods have been devised by which it can be determined with scientific accuracy whether or not the improvement of a road is desirable and the form which the proposed improvement should take. The studies of subgrade soils are showing what practical steps may be taken to secure a satisfactory foundation for the roads and what provision must be made in the design of the surface to overcome the handicap of unstable subgrades. It is now possible to design with practical certainty types of road surface which will satisfactorily serve traffic of several classes of den-



sity and weight and to adopt the type of surface to the traffic with considerable precision. Methods of maintenance are gradually crystallizing which insure the conservation of the investments made; and principles of finance have been evolved, based upon the economic and physical investigations, which seem to assure wise expenditure of the public money and a fair distribution of the expense to the several classes benefited.

### PHYSICAL RESEARCHES AND TESTS

The physical investigations may be divided into those which have to do primarily with the obtaining of facts leading to the better design of roads to carry motor vehicles and investigations which throw more light on the reasons for the physical behavior of the various kinds of road materials under the present-day motor traffic.

The impact experiments conducted on a very large number of road slabs for the purpose of determining the load-carrying capacity of these slabs when subjected to impact loads have recently been completed and the results have been published. These results add considerably to our knowledge of the proper design of pavements for withstanding heavy loads. In order to bring this series of tests to a successful completion it was necessary to design and build not only the slabs to be tested and the testing machine but all testing apparatus used in measuring the impact forces and stresses. Such measurements have always been recognized as presenting very great difficulties, but these difficulties were successfully overcome.

During the past year a number of stress measurements have been taken on concrete roads having different thicknesses and cross sections, as well as different amounts of steel reinforcement. Here again it was necessary to develop the entire technique and apparatus used in such measurements, as no suitable apparatus for this purpose was in existence. The procedure finally developed was entirely successful and the apparatus, built in our own instrument shops, has given excellent results, so that our knowledge of the action of traffic loads in producing stresses in concrete pavements has been greatly advanced.

Another investigation which was begun during the past year with the cooperation of the Rubber Association of America and the Society of Automotive Engineers deals primarily with the measurement of the impact delivered to road surfaces by motor

vehicles equipped with a wide variety of tires and running at various speeds. Other variables include the weight of the vehicle and the load carried. An incomplete set of investigations of this sort was made several years ago. These investigations were recognized as approximate, but even so they have proved of considerable value; in fact, of so much value that the present investigations were requested by manufacturers of automotive equipment. In the present series of tests a very exact method has been developed for measuring impact. This method consists of the use of an accelerometer, which after repeated trial has been made to give results in a most simple and reliable manner. These results will be of very great value, not only to tire manufacturers but to manufacturers of motor vehicles, to road engineers, and to legislators in dealing with legislation pertaining to highways and the control of motor vehicles.

Still another series of tests that have almost been brought to completion during the past year involves the proper design of so-called skew arches, in which the roadway is not perpendicular to the abutments. Here again all test methods and apparatus had to be designed and constructed. These tests have been carried out successfully, and the results, no doubt, will lead to a change in our present methods of skew-arch design.

One series of tests which has attracted considerable attention was conducted on a circular track, built at Arlington, Va., and surfaced with 62 kinds of concrete. The purpose of the test was to determine what are the safe limits of physical properties of aggregates for use in concrete road construction. This question is of great importance. Depending upon the answer to it rests the decision in many cases as to the use of a local material, admittedly not the best, but obtainable without heavy freight charges, or a better material available at a greater distance from the site of the work. The track was 200 feet in diameter and was subjected to rubber-tired traffic by means of a special truck. After thousands of passages, it was established that rubber-tired traffic alone is not harmful to concrete surfaces, but that when equipped with tire chains considerable wear takes place. The safe limit of softness of rock suitable for concrete road construction was likewise established. Various other facts were brought out which will be of great value when they become a part



of active practice in future concrete road construction.

### NONBITUMINOUS ROAD MATERIALS

A series of tests of paving brick was made in cooperation with the American Society for Testing Materials with the idea of determining the effect of variation in the size of the brick upon the rattler loss. Parallel tests for hardness and toughness from both the center and surface were likewise run for the purpose of determining difference in quality between the inside and surface. Four samples of paving brick were examined, two of a light-burned and two of a hard-burned variety. Approximately 260 tests for hardness and toughness were made.

In cooperation with Committee C-1 of the American Society for Testing Materials, a comprehensive series of tests in connection with the proposed compression test for Portland cement was begun. This series of tests involved the making and testing of 1,068 specimens.

A series of tests were run involving the fabrication of approximately 70 concrete specimens with the object of determining the relation between the quality of cement and the quality of the concrete in which it is used. The results of this series indicated that whereas quite high variations in crushing strength were observed at early periods, depending upon the quality of cement used, these variations tended to become much less marked as the concrete aged. This work is being continued during the present fiscal year in cooperation with the California State Highway Commission.

An investigation of the relation between the strength-ratio determination of concrete sands and the crushing strength obtained from concrete in which the sands were used was started and considerable data obtained. It was possible during the year to complete the study of three sands. These sands have been tested in concrete in the form of cylinders for compression tests, beams for cross-bending tests, as well as cylinders and beams for mortar tests.

Several methods were tried with the idea of obtaining a satisfactory scheme for estimating the amount of water required to produce a natural sand mortar of normal consistency. The most practical method so far devised is a method which involves a combination of the surface-area prin-

ciple with a scheme for determining the water-holding capacity of the sand.

A study of laboratory tests for determining quality of rock as concrete aggregate was continued. These studies included an attempt to determine the abrasion loss of crushed-stone samples in such a way as to make the results comparable with the standard test. Seven samples were tested in the laboratory and one sample was submitted to 10 cooperative laboratories for check tests.

The bureau cooperated with the American Society for Testing Materials, the Bureau of Standards, and other agencies, with the idea of developing a universal standard screen scale for testing sieves. Substantial progress has been made along this line and it is hoped that such standardization will shortly result in the use of a single screen scale by all testing laboratories.

Several tests of slag cement were made with a view to determining some method for accelerating the setting and increasing the strength of this cement.

Several sets of tests were made as part of a program in connection with the protective treatment of concrete against alkali action.

Numerous tests to determine the effect of moisture in causing the bulking of sands have been run. In addition, a series of 96 cylinders were fabricated and tested to show the effect of bulking on the strength and yield of concrete. The results of these tests were published in Public Roads.

A method for determining the dye adsorption of soils has been developed and a public patent has been obtained.

### BITUMINOUS ROAD MATERIALS

The bituminous investigations upon which most effort has been expended and which have attracted most attention have been those undertaken to evolve tests of bituminous paving mixtures, particularly in regard to their behavior under traffic. During the fiscal year ended June 30, 1923, a circular roadway was constructed comprising 27 sections of bituminous concrete in which the hardness of the asphalt and proportions of the different sizes of aggregates were varied. These sections were then subjected to the traffic of a motor truck with the object of developing the waves or corrugations which occasionally occur in bituminous pavements, and determining the relative stability of the various

mixtures. During the summer of 1923 marked differences in the various mixtures were observed and toward the end of the season, when about 50,000 trips of a 3-ton loaded truck had been made, the surface of a few sections became badly displaced, and this phase of the test was concluded.

The first series of experimental pavements has since been removed and plans have been completed for the construction of a second series, comprising 28 sections of sand mixtures in which the grading of sand, percentage of filler dust, and percentage, consistency, and character of asphalt are varied, together with 5 sections of stone and sand mixtures. These pavements will be laid in the summer of 1924 and subjected to traffic in the same manner as the first series for the purpose of comparing their relative displacement.

The essential purpose of this field test is, however, to furnish a means of correlating service behavior with laboratory tests of mixtures, and while testing known mixtures under traffic the bureau has been experimenting with laboratory tests with a view to developing a test or tests which will indicate the probable stability of a mixture upon the road. The testing of such mixtures is a field of research to which much thought and considerable experimental study has been given at various times, but which has as yet brought out few positive and fundamental facts.

Considerable work has been done in developing methods of making specimens and in tests under compression, but results have not been sufficiently extensive and consistent to warrant the drawing of definite conclusions in regard to this phase of the testing of bituminous mixtures. A great deal of additional study of the behavior of mixtures under traffic and laboratory tests will be required to locate and evaluate the factors causing or modifying the tendency of bituminous pavements to wave under traffic.

The work of the bureau in the standardization of bituminous materials and methods of testing has been carried on along much the same lines as in previous years. In cooperation with the technical committees on road materials of the Federal Specifications Board, new specifications for oil, asphalt, and tar products have been compiled and the bureau has also assisted in the work of the liquid fuels and lubricants committee of the board. Work in connection with standardization of methods of testing has

been carried on in cooperation with committees of the American Society for Testing Materials, with special reference to the float test and distillation of tar products, the softening point of asphalt, and the asphaltic content of road oils. The bureau has also participated in the work of the materials committee of the Advisory Board on Highway Research of the National Research Council and the committee on tests and investigations of the American Association of State Highway Officials.

Cooperative experimental tests have been carried on with various State highway testing laboratories in connection with the work of the subcommittee on bituminous and chemical testing problems of the committee on tests and investigations of the American Association of State Highway Officials. The progress report of this committee was made at the meeting of the committee on tests and investigations held in New Orleans, December 3 to 6, 1923. The subjects being investigated by this committee are as follows:

- (1) Method for the determination of adhesiveness of bituminous materials.
- (2) Method for the determination of the percentage of Portland cement in concrete.
- (3) Method for testing premolded expansion joints.
- (4) Method for the determination of toughness of bituminous mixtures.
- (5) Method for the determination of asphaltic content of road oils.

### SUBGRADE INVESTIGATIONS

One of the most important lines of investigation which has been developed recently is that dealing with subgrade materials. It is becoming more and more clearly recognized that the kind of subgrade upon which a road is constructed plays a most important part in the durability of the road and governs to a large extent the loads it will carry. Much laboratory work has been done during the past year in the further standardization of laboratory tests for subgrade material, and in addition a great deal of field work has been performed in order that the laboratory tests might be given their proper significance. The investigations point directly to possible ways in which plastic, volume-changing subgrade materials may be improved by the use of admixtures of more stable granular materials. By field observations numerous facts have been determined as to the movement of moisture



in the subgrade, the relation of temperature to moisture content, and as to the possibility of reducing the moisture content. Field studies have been made in Iowa and Minnesota during the spring thaw, and practical field tests on roads have been inaugurated to test the value of the processes for improvement which have been suggested as the result of field and laboratory observations.

### COOPERATIVE RESEARCHES

As in the past, cooperative investigations conducted with a number of cooperating agencies proved to be a very important feature in the research work of the bureau. The projects upon which the cooperative agencies are working have to do for the most part with materials and also with design and economics. The investigations upon which the several cooperating agencies are engaged are as follows:

Purdue University: Various investigations on concrete for concrete roads.

University of Texas: Investigations of soils.

Iowa State College: Investigation of tractive resistance of motor vehicles; investigation of bridge impact; determination of loads on culverts; and an investigation of fuel consumption by motor vehicles when operated over several types of road.

University of Maryland: Various studies in connection with concrete.

Kansas State Agricultural College: The study of wind resistance of motor vehicles.

University of Kansas: Study of tire wear.

Ohio State University: Investigations in subgrade materials.

Pennsylvania Highway Department: Investigations in concrete road design and the better control of concrete in the field.

### TESTING HIGHWAY MATERIALS

One of the important features of the work of the bureau is the routine laboratory examination of materials used in road construction. During the fiscal year, 1,769 samples of various road materials were subjected to laboratory examination, 1,350 in the physical laboratory and 419 in the chemical laboratory. Most of the samples were of materials used in connection with Federal-aid projects and the remainder were submitted by individuals or corporations to determine their general suitability for road construction. One thousand and thirty-

nine samples of nonbituminous materials were classified and examined in the petrographic laboratory, including 372 samples of rock, 274 of gravel, 305 of sand, and the balance of miscellaneous materials.

As outlined in the last annual report, routine supervision in connection with materials control of Federal-aid projects was discontinued by the division of tests and turned over to the various materials engineers. The system of check-testing in certain States, inaugurated last year, has been continued. As a result of this system, several inaccuracies in the technique of testing were discovered and corrected during the year.

A sand-testing outfit for the use of materials engineers was developed and several sets have already been sent out to the districts. It is planned to furnish district engineers with additional sets as needed.

Two laboratory inspection trips have been made in Federal-aid districts 6 and 8, the first during the fall of 1923 and the second in June, 1924. During these inspections all of the laboratories engaged in Federal-aid testing in the 10 States comprising these districts were visited and conferences were had with materials engineers stationed at Montgomery, Ala., and Fort Worth, Tex.

### HIGHWAY ECONOMICS

The economic utilization of the motor vehicle as a transportation facility has opened a new era in the development of transportation. The influence on our national life of the passenger car for social and business purposes and the motor truck for the transportation of commodities is difficult to measure. The rapid growth in the ownership of the motor vehicle demonstrates its value in our economic system, extending and increasing the efficiency of farm operation, developing old and establishing new markets, speeding the conversion of raw materials into finished products, and hastening the processes of marketing and distribution.

In 1923 there were 15,092,177 motor vehicles registered in the United States. The growth in motor-vehicle registration has resulted in a steady yearly increase in passenger-car and motor-truck mileage and an increasing use of the highway. The number of motor vehicles in use in 1923 was twelve times the number in 1913. Gross receipts from motor-vehicle registration fees, licenses, permits, etc.,



have nearly doubled each 2-year period from 1913 to 1921, and increased over 50 per cent from 1921 to 1923. Approximately 80 per cent of the gross revenues from motor vehicles in 1923 was applicable to highway work by or under the supervision of State highway departments.

The result of the rapid growth in the ownership of motor vehicles during the past decade has been a constantly increasing demand for highway service.

With the rapid growth of highway transportation the history of the development of rail<sup>1</sup> transportation has been repeated; conflict, misunderstanding, and duplication of service between the old and new facilities have developed. The utilization of the motor truck for the transportation of freight is a development so recent that its proper sphere as a part of our complete transportation system is still to be established. Recent tendencies in its growth have indicated that its proper field of operation is not in the long-distance movement of commodities, but in a service supplementary to rail and water lines and in the movement of goods within the terminal and short-haul zones. Rail and boat lines are testing the practicability of combined service by the utilization of the motor truck for the movement of freight in the short-haul and congested terminal areas. Its success appears to demonstrate an increased use of the motor truck in this particular field.

The economic development of motor-truck transportation in the future will depend largely upon the stability of organization and the careful regulation of the business.

### THE PURPOSE OF TRAFFIC SURVEYS

To provide an authentic basis for the solution of many of the problems of highway construction, maintenance, and transportation, and to develop sound policies to govern the highway transportation of freight and passengers, highway-transportation surveys have been undertaken in Connecticut, California, Pennsylvania, Maine, and Cook County, Ill. The California report has been published and reports of the surveys in Connecticut, Pennsylvania, Maine, and Cook County will be issued by January, 1925. Data have been sought to measure the amount and type of highway traffic, to record traffic information that will aid in solving the physical and economic problems of highway develop-

ment, to determine the relation of highway transportation to other forms of transportation, and to establish fundamental highway traffic principles.

The principal purposes of the data obtained in the several traffic surveys are as follows:

#### (1) HIGHWAY ADMINISTRATION AND ENGINEERING DATA

(a) To determine daily, seasonal, and yearly traffic flow and distribution on State highway systems.

(b) To estimate future traffic on State highway systems.

(c) To determine the relation of traffic density to the factors responsible for the growth of traffic, such as motor-vehicle registration, production, and population.

(d) To classify highways as industrial, high, medium, or low-type traffic routes based on (1) passenger-car and motor-truck density and (2) motor-truck capacities, gross loads, and wheel loads.

(e) To determine the density of motor-truck traffic and the gross tonnage per mile of highway.

(f) To determine the maximum loading and frequency of critical loads on the highways as an index of pavement width and design requirements, and to establish highway traffic width and design factors for highways contiguous to large centers of population.

(g) To determine the relation between highway width, traffic density, and speed.

(h) To measure the effect of congestion at intersections and "bottle necks" upon the rate of traffic flow.

(i) To estimate the extent to which the improvement of old or the opening of new traffic routes is economically justified.

(j) To correlate traffic loads and density of traffic on the highways with highway construction and maintenance costs.

(k) To determine the type and volume of traffic on the highway as an index to the allocation of highway construction and maintenance funds.

(l) To determine the distribution of motor-truck loads and the amount and frequency of motor-truck overloading.

(m) To compare the cost of various types of highway improvements such as relocations, grade reductions, eliminations of grade crossings, (both rail and highway) and elimination of traffic "bottle necks" with the estimated saving in transportation costs resulting from such improvements.

(n) To compare the earning value of the State highway system (based on passenger-miles and freight ton-miles) with the present worth of the highway system using replacement value minus depreciation as the basis of computing present worth.

#### (2) HIGHWAY ECONOMIC DATA

(a) To obtain highway transportation information concerning the volume of tonnage shipped by motor truck, marketing methods, and the relation of highway transportation to other types of transportation.

(b) To determine the mileage zones of motor-truck haulage and the relation of the type of commodity hauled to such zones.

(c) To estimate the net tonnage of freight transported by regular and irregular trucking operators.

(d) To determine the situs of ownership of passenger cars and motor trucks operating over the highway systems.

(e) To estimate the value of motor-truck net tonnage hauled over the highway systems.

(f) To determine the type of origin and destination as well as the origin and destination of net tonnage of commodities transported by motor truck over the highway systems.

(g) To obtain information concerning the relation of motor-truck transportation to other methods of transportation, particularly as to competition, rates, operating schedules, and delivery time in the short, middle-distance, and long-haul mileage zones.

(h) To obtain data concerning haulage practices of motor-truck operators, the volume of tonnage transported by motor truck between various cities and areas, and additional data of value to governmental agencies charged with the regulation and control of highway transportation.

(i) To estimate passenger-car business and nonbusiness usage of highways.

(j) To determine the proportion of farm traffic on the highways.

#### AN IMPORTANT SURVEY IN THE CHICAGO METROPOLITAN AREA

A survey of highway-truck transportation and marketing in the Chicago metropolitan area is substantially completed. Data have been recorded regarding the organization, functions, operating methods, rates, services, and operating costs of motor-trucking companies, coordination of highway transportation with rail transportation, and the marketing of special commodities.

Motor trucking in the Chicago metropolitan area is largely a short-haul movement with but a small tonnage movement over 40 miles.

The average gross receipts of commercial trucking companies in Chicago show a marked variation in the efficiency of the various companies. Average gross receipts per year per employee range from \$2,000 to \$13,750 in the case of the most efficient organizations. Companies engaged exclusively in motor trucking and whose business consists of city delivery other than to and from railways, supplemented by haulage of freight over 20 miles, are the most successful companies.

The principal bases of rates for motor transportation of freight in the Chicago territory are (1) cost of the service, (2) weight of the shipment, (3) length of haul.

One striking fact observed in this investigation is the almost complete absence of cost records maintained by motor-trucking companies.

The field work of a study of the influence of highway improvement on rural land values in 16 counties in Iowa has been completed, and the final report is being prepared. The conclusions from this investigation, supported by a series of similar investigations now in progress, will determine the limits of increase in rural land values resulting from the several types of highway improvements and assist in determining the amount which rural land can economically contribute to highway improvements on the basis of increased values per acre resulting from the highway improvement.

#### IRRIGATION INVESTIGATIONS

The development of an irrigation enterprise consists of two principal engineering phases: (1) The design and construction of the work necessary to divert and distribute the water to the land; and (2) the location and building of farm ditches and structures, preparation of the land for irrigation, and providing equipment for successful operation of an irrigated farm. The first phase, which usually requires a large expenditure of capital secured by organized effort, has occupied the center of the stage in the past and has often been thought of as being the one engineering feature necessary to be dealt with by those responsible for promoting the enterprise, so that its accomplishment has definitely overshadowed the less conspicuous but no less important irrigation



problems connected with the farm which have usually been left for solution by the individual landowner. So little attention, in fact, has been paid to the farmer's part of the work that irrigation development has lacked the balance necessary for the greatest economic progress. Until quite recently the prevailing assumption was that a constructed canal system would attract settlers of sufficient experience, adaptability, and with the capital necessary to complete the development and discharge the project's obligations.

To this widespread neglect of the settler problem may be traced in no small degree the great financial losses to investors and settlers alike that have occurred at various times during the development of the West. Fortunately, however, the agricultural phase of irrigation is becoming more widely recognized, and the division of agricultural engineering of this bureau has taken a prominent part in the efforts being made to correct past mistakes. It can continue to be of material assistance in solving the farmer's irrigation problems. No enterprise can attain success unless the individual water users are successful, for out of the income from their farms must come the revenue necessary to pay for the operation and maintenance of the irrigation works, interest, if any, on the principal indebtedness, and eventual discharge of the principal itself.

The proper utilization of the Nation's water resources commands wide attention from public agencies and others having to do with irrigation. In line with the need for accurate information are the studies made by this bureau on the utilization of water in irrigation, water-holding capacity of soils, capillary movement of soil moisture, and loss of water by evaporation. Experiments on the duty of water and water requirements of crops have been carried on in cooperation with the State experiment stations of Colorado, Nevada, New Mexico, and with the University of California. The results of these experiments, together with similar data collected in previous years, are being embodied in a series of bulletins, the first of which, *Irrigation Requirements of the Arable Lands of the Great Basin*, has been submitted for publication. *Farmers' Bulletin No. 1348, The Corrugation Method of Irrigation*, has been published during the past year.

Investigations of the water-holding capacity of soils, begun two years or more ago, designed to ascertain the amount of water soils of a given type would retain in each foot of depth of

the root zone after a heavy irrigation, were continued during the past year on typical irrigated and irrigable soils in 12 of the Western States, and it is planned to prepare the results for publication during the ensuing fiscal year. Another important phase of this general subject is the capillary movement of soil moisture, the beneficial effects of which, however, have until recently been generally overrated, for experiments conducted by this bureau have shown that relatively small amounts of water are drawn upward by capillarity where the water table is low. The experiments show, however, that large quantities can be drawn from the surface of a water table within capillary reach of the ground surface, a fact that has an important bearing upon the drainage of such land. While these investigations are still in progress, a report entitled "*The Capillary Distribution of Moisture in Soil Columns of Small Cross Section*" has been published as Department Bulletin No. 1221. Finally, the loss of water by evaporation before it can be utilized by plants has formed the subject of continued experiments at the Fort Collins hydraulic laboratory, where more than 500 hourly observations have been made during the past fiscal year under variable conditions of wind movement, temperature, and atmospheric changes. The increasing demand for water, with its ever-mounting cost, makes necessary the most economical use, to which end the extensive studies of this bureau on water utilization are directed.

#### IRRIGATION AND DRAINAGE LAWS

An equally important group of studies in the field of irrigation economics includes irrigation and drainage laws, operation of irrigation enterprises, the reorganization and consolidation of existing irrigation enterprises, the management of irrigation enterprises, sale and settlement of land in irrigation enterprises, cost of farming under irrigation, and cost of water to irrigators. Studies of existing and proposed legislation at the present time deal largely with irrigation and drainage district laws, which are undergoing changes at a greater rate than are laws covering other features of irrigation and drainage. Engineers of the bureau have kept in close touch with pending legislation and have been of material assistance to legislative committees. During the past year Department Bulletin No. 1177, *Irrigation District Operation and Finance*, was published,



and there was initiated a parallel study of cooperative irrigation companies, the purpose being to determine the conditions under which various types of cooperative organizations have functioned and to which they are adapted. Cooperative ownership and operation of irrigation works is steadily supplanting control from outside, which makes necessary a thorough understanding of the functions and limitations of the several groups of self-governing agencies if mistakes in organization are to be avoided. The assistance given by the bureau in remodeling irrigation enterprises to eliminate waste of water and duplication of overhead expense has been continued and will doubtless be found of further value as these necessary economies are effected.

In the field of irrigation management, which has developed contemporaneously with the settlement and development of the individual irrigated farm, and which has presented for solution some very perplexing problems, the salient feature of water delivery has been extensively studied and a manuscript of a bulletin prepared for publication. In cooperation with the Bureau of Agricultural Economics a number of typical enterprises have been thoroughly canvassed in New Mexico, Texas, and Colorado with a view to determining the cost of farming irrigated land. It is expected that an analysis of the data secured, which will be made during the ensuing fiscal year, will produce important conclusions as to the relation of irrigation costs to other farming costs and the permissible cost of developing an irrigated farm, regarding which there has existed a singular lack of reliable and definite information. Another phase of this problem, viz, the cost of water to irrigators, has been studied in California under 199 organizations and under a large number of individual pumping plants, the field work, including tests of the plants, being nearly completed and the manuscript of a bulletin also nearing completion.

#### WATER FLOW AND LOSSES

Irrigation and drainage structures, concrete pipe, and the flow of water in various irrigation channels have been topics of experimental and field research for several years, including the past fiscal year, and are producing results which will mean a great saving to those who pay for the con-

struction of an irrigation system; in other words, a saving to the individual water-users. Although many vertical drops have been constructed in irrigation canals, progress has been slow in developing a type of drop that will eliminate, without great expense, the destruction to the channels below caused by increased velocity of the water due to the drop. The work of this bureau has been directed toward the design of a drop that will accomplish this purpose. Investigations of drainage structures have culminated in the preparation of a manuscript of a bulletin in which are set forth the best principles of design with the idea of increasing the efficiency of drainage systems and reducing the cost.

Although field studies of concrete pipe have not been made during the past fiscal year, a manuscript is being prepared for publication in which will be embodied the results of previous tests of the qualities of such pipe and its adaptability to irrigation development. Field tests have been conducted during the past year dealing with the capacity of flume structures of wood, steel, and concrete and of metal pipe lines, designed to effect great financial saving in the building of such structures. These studies continue the previous work of the division of agricultural engineering on flow of water in various channels which has attracted wide attention.

A bulletin on flow in metal pipes is in course of preparation, and with further experimental laboratory work it is expected to prepare a bulletin on the capacity of flumes, including the losses of energy at the inlets and outlets under varying conditions.

Seepage losses in channels and percolation through earth dams have formed the subjects of several cooperative studies. The increasing need of economy in the utilization of water resources emphasized above is making imperative a reduction in the margin between gross and net duty of water, a reduction intimately connected with the prevention of transmission losses. Seepage measurements on typical canals in California have been continued in cooperation with the State department of public works, and similar investigations in the Lower Rio Grande Valley have been made in cooperation with the Board of Water Engineers of Texas. The report upon the California work, which is nearing completion and which will be submitted for publication as a

bulletin, will present conclusions as to the causes and extent of seepage losses and the most feasible remedies. Preparation of the report upon the Texas work is in progress. In addition to data on amount, location, and means of prevention of absorption losses in canals, it is hoped that proper loss factors for entire systems may be developed for use in determining allowances for losses in granting water permits. The field observations as to percolation through earth dams, continued during the past fiscal year in cooperation with the Bureau of Reclamation, have been recorded at four dam structures on Federal reclamation projects.

Silt and gravel transported by streams cause serious troubles in canal management in some sections of the West. The silt problem on the Colorado River particularly has attracted a great deal of attention because of the volume of silt carried by that stream and the effect upon canal diversion and maintenance. This problem alone is of sufficient economic importance to justify several years of investigation by this bureau. In fact, it is not overstating the case to say that the great irrigation systems of the lower Colorado can reach final success only by a proper handling of the silt question. Plans are now under way to complete the compilation of the results of these studies in order to make them available for publication. During the past year, in cooperation with the Texas Board of Water Engineers, similar studies have been started on certain streams and reservoirs in southwestern Texas, and the work is well under way, its chief value being to determine the life and consequent feasibility of reservoirs for irrigation and flood control. On certain other streams high canal maintenance costs are caused by inundations of gravel carried by the streams during flood periods and lodged against structures and along the upper reaches of the canal systems. Under the supervision of this bureau dams have been built on several Utah streams above canal intakes to catch this gravel, and periodical surveys are in progress to determine the amount of the material so withheld. This work to date has been very gratifying in increasing the effective use of these streams, and it is felt that the experiments will result in provision of means of utilizing the flow of mountain streams now partially or wholly wasted.

## THE DRAINAGE OF IRRIGATED LANDS

In many irrigation communities the problem of draining the irrigated land sooner or later demands attention. This problem bids fair to become increasingly serious with the increase in area of irrigated land throughout the West, particularly in view of the fact that much additional irrigated land will be located at higher levels than present areas and will undoubtedly contribute to the drainage troubles of the lower-lying lands. The bureau has been active in giving practical advice and assistance in organization, financing, and construction to communities needing drainage in a number of States. The results of an investigation on drainage conditions in Hawaii made during the previous fiscal year, have been embodied in a report. Department Bulletin No. 1207, Drainage District Assessments, has been published during the past year.

Drainage run-off from irrigated land has been systematically measured in Washington, Oregon, Idaho, Utah, and New Mexico, the bureau cooperating in such work with the officers of Yakima County, Wash.; the experiment substation at Prosser, Wash.; the New Mexico Agricultural Experiment Station; and various drainage districts in Utah. These field studies embrace measurements of the discharge from open and closed drains, depth to ground water in observation wells, percentage of alkali in soil and water, crop censuses, and the relation between the quantity of water applied in irrigation and the resulting quantity of drainage water. In the Mesilla Valley of New Mexico, in which construction of open drains has been practically completed, the observations of behavior of the water table will be valuable in determining the practical results of such open drainage systems after the valley is supposed to have been completely drained. Further investigations have been made of the depth and spacing of drains, the swelling of clay, maintenance and operation of drainage systems, durability of cement tile in alkaline soil, and the removal of salts by drainage.

The bureau has continued its studies of pumping both for drainage and for irrigation. The investigation conducted in Arizona during several previous years to determine the value of pumping from wells as a means of draining water-logged lands has been supplemented during the past fiscal



year with additional field work, and a report of the entire investigation is in course of preparation for publication. That such a publication will be of value is indicated by the interest taken in other communities in this means of possible relief from drainage difficulties which at the same time might increase the water supply for other lands. Provision for such pumping may readily be an important feature of the construction plans of many future irrigation enterprises, particularly where hydroelectrical development is practicable in conjunction with storage for irrigation.

In the field of irrigation pumping the bureau has recently issued Farmers' Bulletin No. 1404, *Pumping from Wells for Irrigation*. In connection with the work on cost of water to irrigators in California, which includes the cost under individual pumping plants, the pumping plants have been tested for efficiency. There is also under way a project for studying the pumping of water from rivers, canals, and other open-water surfaces. This project has been started on the Snake River in Idaho and Oregon on account of the experience already developed there; later it will be extended to parts of Utah, California, and Texas. Of particular interest and enlightenment should be the results of the investigation along the Snake River, which flows in a relatively deep canyon from which water for irrigation must be raised through high vertical lifts, necessitating heavy operation costs to reach the extensive areas of fertile yet barren lands above it. In cooperation with the Nevada Agricultural Experiment Station, determinations of the capacities of nonflowing artesian wells in southern Nevada have been continued. While the tests show a material increase in capacity resulting from pumping, they are not conclusive, but it is hoped that with the use of a deep-well turbine pump the limit of these capacities may be determined.

A thorough test of a large so-called "water mound," of which there are many in Las Vegas Valley, made to prove or disprove the value of such mounds as a source of water supply by means of pumping, showed that the pump discharge, while holding the spring at a constant level as low as it was possible to hold it without exhausting the spring supply, was no more than the normal flow of the spring. Measurements of the flowing wells in the Las Vegas artesian ba-

sin, undertaken with a view to determining the permanency of the underground water supply, were continued. While definite conclusions may not yet be drawn, it appears that in certain sections the supply from the upper artesian strata has about reached the limit of economic development.

### WATER-MEASURING DEVICES

The hydraulic laboratory at Fort Collins, Colo., in conjunction with the more recently constructed field laboratory at Bellvue, on the Cache La Poudre, near Fort Collins, has continued to be the means of developing much exact information on measurement of water and its practical application to irrigation needs. The most important work during the past year has been in developing the improved Venturi flume, which has been further tried out under actual field conditions in the Arkansas Valley and is proving to be especially suited for streams bearing excessive amounts of sand and silt. Flumes ranging in size from 1 foot to 10 feet, the largest with a capacity of approximately 600 second-feet, are in successful operation. Deposits are found on the floor of the small-sized structures where very small heads are used, but tests show the error to be only 1 to 2 per cent from the calculated flow; the large-sized flumes have shown no deposit.

A number of other measuring devices and water-recording instruments have been tested at the laboratory. Further work in the design and invention of apparatus has resulted in improvements on the new type of current meter originated by an engineer of this bureau, as well as in the designing of special apparatus for measuring the carrying capacity of pipes, evaporation from ground and water surfaces, and the moisture transpiration of plants.

At the request of the Secretary of the Interior, special investigations were completed during the past year on two projects proposed for construction by the Bureau of Reclamation—the tricounty irrigation project of central Nebraska and the Baker project of Oregon. The study of the tricounty project was initiated during the preceding fiscal year, but was largely carried on and was completed during the year just ended. A distinctive feature of this project is that it lies on the border line between the humid and semiarid portions of the



United States and embraces an area of land already largely cultivated but on which the decreasing yields under dry-farming conditions have been approaching a critical stage. The report deals with certain agricultural engineering phases, chiefly the average monthly deficiency of rainfall during the growing season, the water-holding capacity and probable productivity of the soils, methods of crop rotation possible with irrigation, approximate amount of water needed to supplement the rainfall in order to insure profitable crop production, approximate increase in crop production made possible by subsoil storage, economic advantages of using only direct-flow waters or of providing storage facilities, and the essential features of remunerative irrigation farming.

The proposed Baker project was studied in conjunction with the Bureau of Soils and the Bureau of Agricultural Economics and was the subject of a combined report of the three bureaus. This report went carefully into the phases of agricultural engineering and irrigation economics, a thorough knowledge of which is now coming to be recognized as being vital in planning a successful irrigation enterprise. It dealt in detail with the features of soil quality and adaptability for irrigation, including the presence of alkali, topographic features and their effect upon costs of canal construction and preparation of the land for irrigation; methods of preparation of the land; necessity for drainage measures; equipment required by the settler for recommended types of farming; amount of capital needed by the settler; and probable farming profits.

As in previous years, the bureau has been frequently called upon for advice and assistance in irrigation matters; in fact, it is estimated that during the past year fully 20 per cent of the aggregate time of our engineers has been occupied with such work. While the published bulletins of the department and of cooperating agencies are the means of widely disseminating the results of special studies, such publications necessarily embody only the salient features of a subject and may often be advantageously supplemented in particular cases by the personal aid rendered by irrigation specialists. It is felt, therefore, that the time devoted to such work, so long as it does not interfere materially with research, is time well spent in aid of a better agricultural development.

## DRAINAGE INVESTIGATIONS

During the past four years, drainage undertakings by the owners of the lands to be drained have included comparatively few new reclamation projects. New enterprises have been established for increasing the productivity of lands already largely under cultivation, but much of the drainage undertaken since 1920 has been by districts that had previously completed their original reclamation plans. Owing partly to lack of adequate data upon which to base the design of reclamation works, and partly to the limits of cost set by the landowners, considerable portions of many of the districts were not provided with adequate drainage outlets. Such districts now are enlarging and extending old ditches and constructing supplementary new ditches, sometimes even rearranging the main lines of drainage. Other districts are installing new pumping plants to secure greater capacity or to effect savings in the cost of operation.

The work of the division of agricultural engineering, during the fiscal year 1924, has been limited to research investigations even more than in preceding years, in accordance with the policy of having the State agricultural colleges do as large a part as practicable of the extension work. This permits more satisfactory progress to be made in the investigational activities, and the collection of a larger amount of information for use by the extension workers and others. The fullest cooperation possible is given to the colleges in applying the results obtained to the conditions in their respective States, and in the study of their general drainage problems.

The major subjects of investigation by the division of agricultural engineering are most profitably continued through periods of years, accumulating data that, even though final conclusions can not be attained for many years, are of increasing value as a basis for the design of new drainage works or the reconstruction of older undertakings. The almost innumerable combinations of soil, topography, and ground covering are multiplied by the variations in amount and distribution of rainfall. Determination of the magnitude and frequency of the extreme conditions for any particular area is, of course, a very important step in designing the drainage works. An approach to the maximum occurs very infrequently, and it is always possible that any past record may be ex-

ceeded in the future. However, measurement and study of even moderately severe conditions are very helpful, when more exceptional data are lacking, for estimating the worst conditions for which the works should be designed.

### RUN-OFF INVESTIGATIONS

The run-off investigations have been continued along the same general lines as in previous years, the continuity of the records at certain stations being not the least important part of the results secured. Further measurements have been made of run-off rates from five areas in the Little River drainage district in southeastern Missouri, ranging in size from 150 to 75,000 acres. None of the precipitations of high intensity, as shown by the rain gauges established at 10 points, covered the district generally, so only small rates of flow were secured from the largest basin and from the flat-land area. However, high discharges measured from the smallest area of rough topography confirm the conclusions of the preceding year that drains for such areas, including highway culverts and sometimes storm sewers, should have greater capacities than generally have been considered necessary. The measurements from the hilly areas of 6,000 to 22,000 acres supplement those previously secured and add materially to the available data for designing adequate and economical drainageways where the run-off from rolling land is to be carried across level drained land. Along Illinois, Mississippi, and Missouri Rivers are many drainage districts for which these run-off data are desired by persons in charge of rectifying mistakes that were made in the design of such floodways.

Measurements of run-off and determinations of resistance coefficients in the formulas for computing channel capacities have been begun during the year in Bolivar County, Miss., and in Champaign County, Ill. As in the Little River drainage district in Missouri, rain gauges over the drainage basins and automatic water-stage registers in the drainage outlet channels furnish the data for comparing amount and distribution of run-off with amount and distribution of precipitation. Current meter measurements of the flow at the various stages and simultaneous determinations of the water slope serve to interpret the water-stage records in terms of discharge and to determine the hydraulic coefficients. The run-off

is being measured from eight drainage areas in each of the counties. Those in Bolivar County are of flat topography, typical of much undrained or partly drained land along Mississippi River in Mississippi and Arkansas. The areas in Champaign County are of slightly rolling topography, practically cleared of timber, and some are completely underdrained with tile. Of the 16 channel sections that are being studied for capacity and resistance to flow, 12 are dredged ditches and 4 are natural river channels. On some of the ditches in Champaign County the resistance coefficients will be determined while the waterways are considerably choked with vegetal growth and again after being cleared of that growth, which will afford a comparison bearing upon the value of keeping drainage ditches in good condition. The investigations in these two counties have not been in progress long enough to secure definite results, but the data to be secured will be a valuable addition to those now available.

Preparations were made for gaugings of flood discharge in the St. Francis floodway in northeast Arkansas. That waterway, made by building two lines of levees about 1,200 feet apart between which the flood water will flow over the natural ground surface, offers an excellent opportunity for determining coefficients of resistance to flow through woodland from which only the merchantable timber has been removed. Such floodways of large capacity are practicable in many drainage districts in the lower Mississippi Valley, but the existing data for computing the capacities, and consequently the proper sizes, are extremely meager. The determinations will be of much value also in planning the location and height of levees along the larger rivers, where, as in many locations, it is impracticable to confine the floods to the low-water channel. During the year past there was no depth of flood sufficient for making practical measurements in this floodway, but measurements will be made in the coming year if normal floods occur.

Run-off records for the drainage basin of Luxapallila River in Fayette and Lamar Counties, Ala., have been secured in continuation of those obtained during 1923.

Data were collected as to the cost of operating drainage pumping plants along the Illinois River and the Mississippi River between Muscatine, Iowa, and the mouth of the Illinois. A number of the districts have within



recent years replaced their steam-power plants with electric motors, and others are contemplating a similar change or the installation of internal-combustion engines of the Diesel or semi-Diesel types. There has been a great increase since 1917 in nearly every item entering into the cost of pumping, particularly fuel and labor. The increase in cost of electric power has been very much less, no doubt because of public regulation of rates. While only partial data were obtainable concerning most districts, analysis of the information secured should indicate in some measure the comparative economy of the different kinds of power. There has been little experience so far with the Diesel types for drainage pumping, but the low cost of fuel per horsepower output seems to promise economical operation in this field.

### DISCHARGING CAPACITY OF CULVERTS

The experimental studies of 1923 on capacities and forms of culverts, at Iowa City, Iowa, in cooperation with the State University of Iowa, were continued through the fiscal year 1924. The experiments this year were made on concrete box culverts flowing full; that is, with the ends of the culvert opening submerged. This will be the critical condition ordinarily, where the top of the outlet opening is not above the high water in the channel leading from the structure. Nearly 1,100 tests were made on culverts of 24, 30, and 36 feet length, with openings 2 feet square and 3 feet square and some with width increasing through part or all of the length.

It was found that merely rounding the edges of the entrance opening increased the discharge of the culverts from 7 to 10 per cent over the discharge with square edges. Culverts having the rounded edges and widened through the downstream third of their length to twice the width at entrance had capacities 56 to 59 per cent greater than those of equal entrance opening having square edges and a uniform size throughout. The discharge through a culvert 2 feet square at entrance with rounded edges, gradually increased to 4 feet wide by 2 feet high at outlet, was 86 per cent greater than that of the straight culvert 2 feet square with sharp edges. This is equal to or slightly greater than the computed capacity of a culvert 2 feet by 3 feet with rounded edges.

Comparison of the capacities found for the box culverts 30 feet long with

those for the pipe culverts of the same length under experiment during the preceding year shows that the 24-inch square culvert, which has about 27 per cent greater area of opening, with rounded entrance, will discharge about 20 per cent more water than a 24-inch vitrified clay pipe laid with bell end upstream, when flowing full; about 30 per cent more than a 24-inch concrete pipe, with the beveled inner edge upstream; and about 70 per cent more than a 24-inch corrugated metal pipe culvert. The computed average velocities were practically equal for the concrete pipe and concrete box culverts. The 27-inch vitrified clay pipe culvert had practically the same cross-sectional area and same capacity as the 24-inch box culvert with rounded edges at entrance, for the 30-foot length, while the 42-inch clay pipe had about 7 per cent greater area and an equally greater capacity than the 36-inch concrete box culvert with rounded entrance.

### EFFECT OF ALKALI ON CONCRETE TILE

The experimental studies of concrete drain tile in Minnesota, being conducted in cooperation with the University of Minnesota and the State Department of Drainage and Waters, have been broadened and extended. The manufacture of test cylinders in the laboratory at St. Paul has been continued, with the tests of these and of older specimens after storage in alkaline solutions of various strengths. In all, some 10,000 cylinders have been made for studying the progressive deterioration of the concrete, especially in solutions of magnesium and sodium sulphates, which are the particularly harmful salts that are found in some of the Minnesota soils. A loss of 50 per cent in compressive strength was found for the cylinders of 1:3 mix stored in magnesium sulphate solution of 1 to 4 per cent for 17 weeks or more, as compared with like cylinders stored in distilled water.

Tests have been begun on cylinders cured in a steam chamber, in water vapor at or near a temperature of 212° F. The tests so far, including year-old specimens of 6 series, indicate that this method of curing greatly increases the resistance to attack. Only the slightest signs of deterioration have been evident in specimens stored in the alkaline solutions for 90 weeks. Long-time tests will be needed to determine the actual value of this steam curing, which is very different from the ordinary steam curing in com-



mercial tile plants, where a temperature of more than 100° F. in the curing rooms is not often obtained.

Five sets of experimental drain tile, 1,500 pieces in all, have been installed during the year for observation and test under field conditions. These installations were made in a neutral mineral soil on the university farm at St. Paul; in a sulphate soil in Lyon County, Minn.; in a raw peat soil in Anoka County, Minn.; in an alkali soil containing sulphates and chlorides in Cass County, N. Dak.; and in Medicine Lake in Pennington County, S. Dak., where the water contains about 4 per cent of sulphates, very largely of magnesium and sodium. Some 2,000 of the test cylinders, also, were placed in the same lake.

A reconnaissance has been made of the lands subject to overflow by Mississippi River between St. Paul, Minn., and Rock Island, Ill., to investigate the practicability of reclaiming these lands for agriculture. Of some 340,000 acres subject to inundation at maximum flood stage, outside of low-water channels, it appears that the protection and drainage of probably 12 districts, reclaiming approximately 85,000 acres, could be accomplished at average costs of from \$50 to \$75 per acre for the various districts. Considerable farm drainage and clearing of woodland not included in these cost figures would be required before all the land would be ready for cultivation. Buildings and other private and community improvements would add further to the cost of the developed farms. Pumping of the drainage water would be necessary during the greater part of each year. Determination of the fertility of the soil was not attempted, and it is quite possible that in one or more of the districts suggested the land when reclaimed would not be worth the cost.

#### STUDIES OF FARM-LAND EROSION

An experimental study of erosion of farm land has been begun in North Carolina, in cooperation with the agricultural experiment station. The first experiments will go into the rate of erosion and its relation to the amount and intensity of rainfall, the ground slope, the soil type, and the kind of crop on the land. Thus far, six plots of various lengths up to 200 feet, having a fairly uniform slope of approximately 9 feet in 100, have been inclosed by tight fences, so that the eroded material is caught and weighed. In two months the erosion from a Cecil sandy-loam soil cultivated in cot-

ton has been 25 tons per acre, or about 0.2 inch depth. So short a period does not give dependable results, and the experiment will be continued. It will be extended to include field and laboratory studies of terracing for the prevention of erosion. Terracing has been practiced for many years in the South Atlantic States, but the value of this method of treating hillside fields is not limited to that region. The use of terraces is being urged by agricultural colleges for lands in the Ohio and Missouri Valleys, and will be beneficial elsewhere. This subject has received some little attention in previous years, but knowledge of the proper design of terrace systems under various conditions of climate, soil, topography, and culture is far from complete.

The studies in North Carolina of the effect of varying the depth of tile drains upon the depth of ground water in a Norfolk fine sandy-loam soil, and of the effectiveness of open field ditches in the drainage of muck soil, have been continued but not to quantitative conclusions. The year's observations emphasize, however, that the deeper drains maintain a lower general elevation of the plane of saturation, and that it is difficult to maintain open ditches at the desired depth in the muck.

#### DRAINAGE AND IRRIGATION OF SUGARCANE AND CITRUS FRUIT IN THE GULF STATES

The varying rainfall in the Gulf-coast region provides in some years an excess of moisture for the best growth of sugarcane and in other years an insufficiency. The study of irrigation for cane, undertaken in the preceding year in cooperation with a sugar planter in southern Louisiana, has been broadened to include a study of the practicability of drainage for that crop. The precipitation was above normal during the growing season of the crop harvested in the fall of 1923, and the several acres of better drained land yielded more cane per acre than the plots with average drainage selected as comparable in other respects. The results concerning irrigation were inconclusive, owing to the large rainfall, but lack of rainfall during the summer of 1924 seems to indicate that irrigation rather than drainage will show results in the crop to be harvested this fall. Both for drainage and for irrigation only the average results over a period of years will show what increases in yield may be obtained and whether profits may be

expected from the installation of drainage or irrigation improvements.

On the east coast of Florida, in places, protracted periods of drought have been attended or immediately followed by the death of many trees in citrus orchards. In one grove some 200 trees were removed this year. The loss of a tree entails not only the cost of removal and replacement but also the loss of crop for five or six years until the young tree is yielding profitably. An investigation has been begun to determine whether a deficiency in the soil-moisture content really is the cause of the losses, and whether irrigation will remedy or prevent the injury. In some of the affected areas frequent determinations of soil-moisture content are being made, and experimental irrigation in connection with fertilization of some of the trees that had begun to show the characteristic wilting is being carried on at the same time. The owners of the orchards where the experiments have been started are cooperating in the work. The investigation will be continued in cooperation with the citrus growers and will include studies of the movement of the irrigation water in the soil, the quantity to be applied, and the most economical and effective methods to be used.

In cooperation with the extension department of the agricultural colleges in a few States, advice and assistance have been given in farm drainage, terracing, and the initiation of community drainage enterprises as in previous years. Besides the aid to individual farmers whose drainage and terracing improvements will be effective demonstrations in their respective localities the bureau planned and supervised the installation of a tile drainage system for about 20 acres of a 50-acre pecan orchard in Lee County, Ga., upon which the Bureau of Plant Industry is conducting experiments.

#### DISTRIBUTION OF SURPLUS WAR EXPLOSIVES

The purposes of the distribution of surplus war explosives to farmers, which has been carried on for three years, are three in number: (1) To make an economical use of this material, which otherwise would be destroyed as waste; (2) to enable farmers who need explosives to save money in buying a suitable material; and (3) to use such explosives as a means of interesting farmers in improving their lands and to educate them in the best

means and methods of doing such work.

At the beginning of the fiscal year the bureau had on hand 150,000 pounds of cartridged picric acid for agricultural work. This was distributed during July and August. The available supply of surplus war explosives then consisted of some 8,000,000 pounds of trinitrotoluol (TNT.) and 10,000,000 pounds of sodium nitrate. After extensive investigation a formula for an explosive made of these two materials was developed, and this explosive, "sodatol," was used by thousands of farmers throughout the country and gave universal satisfaction.

Bids for preparing the sodatol were received from five manufacturers of explosives in July, 1923, and the contract was let to the lowest bidder. The price agreed upon ranged from 4.07 to 5.20 cents per pound, and shipments were made from Repauno, N. J., Barksdale, Wis., Ashburn, Mo., Louviers, Colo., or from Dupont, Wash., in order to secure the lowest delivered price to the farmers.

More than 14,000,000 pounds of sodatol had been distributed in nine months when shipment of the last of this material was made, in June, 1924. The distribution to farmers was handled by cooperation with some agency in each State, usually the agricultural extension service of the State agricultural college. These agencies secured the orders from the individual farmers, pooled them into carload lots, looked after the details of the distribution when the shipments reached destination, and carried on the educational work connected with the use of the explosive. The success of the distribution is largely due to the enthusiastic cooperation given by the State agencies. The following table gives the distribution by States:

	Pounds
Alabama-----	76, 000
Arkansas-----	1, 000
California-----	50, 000
Connecticut-----	38, 900
Florida-----	21, 000
Georgia-----	36, 000
Hawaii-----	1, 000
Idaho-----	531, 200
Iowa-----	225, 250
Kansas-----	1, 700
Kentucky-----	38, 150
Louisiana-----	32, 600
Maryland-----	1, 000
Michigan-----	1, 533, 000
Minnesota-----	1, 773, 500
Mississippi-----	71, 100
Missouri-----	101, 000
Montana-----	135, 200
Nebraska-----	47, 900
New Jersey-----	500
New Mexico-----	500



New York-----	26,000
North Carolina-----	657,650
Ohio-----	17,000
Oregon-----	980,400
Pennsylvania-----	35,500
South Carolina-----	180,700
South Dakota-----	73,000
Tennessee-----	72,800
Texas-----	40,050
Washington-----	2,269,250
Wisconsin-----	5,044,200
Total-----	14,113,150

No charge was made for the explosive materials, but the farmers paid the cost of preparation, the overhead expenses of the distribution, and the freight charges. As nearly as can be determined, the average cost of sodatol to the farmer at his railroad station was 6½ cents per pound, while the average price of an equivalent amount of commercial explosive in carload lots was about 17 cents. Thus the saving to the farmers on the total amount distributed can be conservatively estimated as not less than \$1,500,000. This amount would be greatly increased if comparison had been made with the retail selling price of the commercial explosives. Reports indicate that at least 50,000 farmers used this explosive and so were benefited by the distribution.

#### COMMENTS ON THE VALUE OF SODATOL

A large part of the sodatol was distributed in States having cut-over lands, where it was used, not as an inducement to get more settlers on the land nor to open up new areas for settlement, but by farmers who are struggling to get enough land under cultivation to make each farm self-sustaining. However, a greater amount was used in making lands already in cultivation produce more crops at a less cost, by removing stumps and boulders and squaring up irregular fields. The use of sodatol was by no means confined to the States generally considered as comprising the cut-over areas; in fact, great interest was shown in many States, such as Iowa, which are ordinarily thought to have completed the clearing of the land. A recent survey shows that in one of the best agricultural counties in the lower peninsula of Michigan 35 per cent of the total land now being cultivated is stump land.

The value of this use of surplus war explosive is attested by all the reports from the State distributing agencies. The report from Wisconsin states, in part:

Individual efficiency \* \* \* is the first and shortest way out of the present farm difficulty, and the very large increase in the use of explosives by southern Wisconsin farmers is an indication that we have been able to sell this idea to them. This material [sodatol] has not been used largely to increase acreage and production, but rather to remove stumps and stones which have been obstructing cultivation, causing costly delays and extensive repairs to machinery and equipment, loss of labor and increased general cost of production, and consequent lowering of profits. Thousands of farms in southern Wisconsin still need land clearing and land reclamation in order to make them efficient farm units.

The Michigan report says, in part:

During the period of distribution of surplus war explosives, approximately 200,000 acres have been cleared \* \* \*. The total amount of surplus war explosives distributed [in Michigan] is 2,718,300 pounds, which would indicate that there was used an average of 13.6 pounds per acre. As our average saving is 14 cents per pound, the average saving per acre cleared would be only \$1.90, but this is hardly fair. Fully 50 per cent of the 200,000 acres used practically no explosive. The other 50 per cent used at least 80 per cent of all the explosives, which would indicate a saving of more than \$3 per acre. \* \* \* We feel free to say that 60,000 acres would never have been cleared had it not been for surplus war explosives.

Minnesota reports that about 62,800 acres of land were cleared of stumps and boulders with sodatol and that the saving over the cost of commercial explosives was \$6.13 per acre, or a total of \$385,000.

Due in part, at least, to the interest aroused in farm development by this work, a number of investigational projects have been undertaken by various States. These investigations in general seek to determine the best methods of getting rid of stumps and boulders and the value of the benefits obtained by such removal.

The distribution of sodatol was completed in June, 1924, and plans have been perfected to begin the distribution in a similar manner of another explosive called "pyrotol," the formula for which was developed in the division of agricultural engineering. This explosive will be composed largely of ground smokeless powder and sodium nitrate, and probably will be the last surplus war explosive to be distributed.

#### FARM MECHANICAL PROBLEMS

The importance of power in agriculture has long been recognized, but it becomes much more apparent in the light of data collected in a survey of the use of power on farms in the United States made during the past



year by this bureau. More primary power is used in agriculture at the present time than in any other industry except transportation. Power and labor represent over 60 per cent of the total cost of carrying on the farming operations. Nearly 16,000,000,000 horsepower-hours are used annually on farms in the United States, and the cost exceeds \$3,000,000,000 each year. It is by the use of this power that the American farmer has been able to multiply his production by at least 3 in the past 75 years. The average amount of power used on farms in the United States at present is about 2,500 horsepower-hours per farm, about 1,500 horsepower-hours per farm worker, and about 32 horsepower-hours per acre of improved land. It requires about 32 horsepower-hours to produce, harvest, and haul to market 1 acre of crops on the average.

Electricity has been substituted for other forms of power in many industries; and if it could be supplied to farmers at a cost which would admit of profitable returns, would greatly increase the productiveness of agricultural workers. The cost of long-distance transmission, distribution, and transformation, the small number of consumers per mile of transmission, and the small intermittent loads of the individual consumers impose conditions under which the central power companies could not now secure a profitable return on their investment. The only way in which the cost of central-station energy can be so lowered as to render the general use of electricity in agriculture profitable is to increase its profitable agricultural uses.

With this in view, the committee on the relation of electricity to agriculture, composed of representatives of the American Farm Bureau Federation, the American Society of Agricultural Engineers, the National Electric Light Association, and the U. S. Departments of Agriculture, Commerce, and Interior, has been formed. The purpose of the committee is to formulate a program to serve as a guide in planning and conducting investigations as to the profitable uses of electricity in agriculture. In order that farm problems might be better understood, the committee requested the Department of Agriculture to make a general survey of the use of power on United States farms. This survey, the report of which is practically completed, was made during the past year and consists largely of a compilation of all reliable informa-

tion now available. The report shows the various present uses of power on the farms, the amount of different kinds used, the power required for some of the major farm operations, and the geographical and seasonal distribution of power requirements, and contains much other information of a statistical nature. It will be of value to all those interested in the development of power equipment and the production of farm machinery, as a basis for investigations to determine the fundamental facts regarding the actual power required in farm operations and for the design of farm equipment.

The increasing cost of coal has brought into the market a large number of oil burners for house heating. Because of the many requests for information and advice concerning them, an investigation was undertaken in cooperation with the Bureau of Home Economics for the purpose of obtaining first-hand information regarding the efficiency and operating characteristics of the several types offered the public. As the work was undertaken late in the year and it was necessary to install considerable laboratory equipment, the investigation has not progressed to the point where definite statements can be made. The data so far obtained indicate that information obtained will be of value to manufacturers who wish to increase the efficiency of the burners and to users in operating the equipment after installation.

#### DEVELOPMENT OF COTTON-DUSTING MACHINES

The work of developing and testing cotton-dusting machines and equipment for spreading insecticides to poison the cotton boll weevil has been continued through the year in cooperation with the Bureau of Entomology, with headquarters at the bureau's laboratory at Tallulah, La. Apparatus for spreading calcium arsenate from airplanes and balloons has been given most attention during the year. Fairly satisfactory progress has been made, though a great deal of additional experimental work probably will be necessary before the many possible variations in the equipment have been tested and the anticipated degree of perfection is achieved. New or improved types of dusting machines continue to be submitted by private manufacturers for test, and an engine-driven traction duster has been developed.

The investigation in cooperation with the Bureau of Plant Industry looking toward greater economy and efficiency in the transportation of fruits and vegetables included tests made at Arlington, Va., on two refrigerator cars furnished for the purpose by the Pacific Fruit Express, to determine the effect of body icing on the car insulation. Body icing is the use of ice directly upon the lading, a practice that is used to a limited but increasing extent in some parts of the country, although the melting ice keeps the floor of the car wet while being so used. One of the cars had been used for shipments with body icing, and the floor had been more or less saturated with the water; the other car had not been so used, according to the records, and the floor had been kept dry. The tests consisted of measurement, by direct methods, of the loss of heat through the floors of the cars. Some of the testing apparatus being new in type, considerable experimentation was required to develop satisfactory methods, but sufficient work has been done to show that the practice of body icing results in appreciable damage to the floors of the refrigerator cars.

The refrigerator car of the Bureau of Plant Industry was entirely reconstructed to conform, as regards the internal arrangement, with the recommendations made by the Department of Agriculture and promulgated during the World War by the United States Railroad Administration in its standard refrigerator-car specifications. Further provision was made for readily changing the bulkhead and bunker construction, so that experiments on the effect of various modifications can be made. The work was done at Potomac Yards, entirely at the expense of the Bureau of Plant Industry. This project now has a refrigerator car suitable for either laboratory or road tests, including the actual shipment of perishable products in comparison with other cars.

During the year specifications were prepared for the purchase and installation of new equipment and the rearrangement of some of the present equipment in the cold-storage laboratory of the Bureau of Plant Industry at Arlington Experiment Farm. The new equipment includes two ammonia compressors and one brine tank, already secured to add to the previous equipment, and a new electric switchboard yet to be purchased.

To provide means for studying methods of minimizing damage done by

frost, in connection with the study of transportation of citrus fruits, equipment was needed for experimentally freezing the fruit on the tree. For this purpose a sectional freezing chamber of insulated panels was designed and constructed so that one man can place it about and over the tree to be frozen. Low temperatures are obtained by a specially designed air-cooling tank. After tests on apple trees at Arlington Experiment Farm the apparatus was shipped to California and used for freezing citrus trees, and thereby considerable data were obtained concerning the effects on both tree and fruit of different freezing temperatures maintained for various periods of time. In operation, temperatures in the chamber were maintained fairly steadily throughout the night 30° to 35° below those outside, with a variation of only 5° to 7° between the top and bottom temperatures inside.

#### VENTILATION OF FARM BUILDINGS

The importance of the proper ventilation of farm buildings in which stock and crops are housed is becoming more and more generally recognized. As it has been necessary to provide man with warmth, light, and abundant fresh air in his working quarters, so it has been found necessary to provide farm stock with adequate shelter and to maintain them in good health if maximum production is to be had. Crops must be stored on the farm for greater or less periods of time in the interest of orderly marketing or to complete the processes of production, as in the case of tobacco. In practically every instance it has been found that the question of ventilation is of vital importance. The problem of providing proper ventilation resolves into two major phases, of which one is the determination of the atmospheric conditions that must be maintained within the structure to insure health and productiveness in animals and to prevent spoilage in stored crops. This part of the problem is a subject for the animal nutritionist and other specialists in the animal and crop production. The other phase is an engineering problem and consists of devising the means for obtaining and maintaining the desired atmospheric conditions. The use of mechanical equipment for this purpose by the farmer is prohibited by the cost of installation and operation, so the desired end must be attained through the utilization and control of natural air forces. Efforts to devise



efficient means of doing this have been hampered by the lack of knowledge relating to unknown and uncontrollable factors affecting the ventilation of farm buildings. The investigation to determine the fundamental principles upon which the design and operation of ventilating systems might be based was continued during the current fiscal year.

From observations and tests made under operating conditions in a number of dairy barns, data have been secured which will be of material assistance to engineers and designers of ventilating system as well as to the farmers who must operate them. Farmers' Bulletin No. 1393, Principles of Dairy Barn Ventilation, has been prepared and published during the past year, to acquaint farmers with the necessity for the ventilation of the dairy barns, the principles involved, and the systems in common use. Papers also were prepared and presented before technical societies.

## PLANS OF BUILDINGS AND EQUIPMENT

There were prepared in the bureau a number of plans for farm buildings and equipment, many of which were designed for general distribution at the request of or in cooperation with other bureaus of the department. The investigations of specialists in animal husbandry and crop production frequently result in recommendations as to conditions to be obtained within buildings intended for the housing of animals or crops, or as to facilities or equipment embodying or permitting of the adoption of such recommendations, and the best means of conveying to the farmer the information that will assist him in building construction. As the preparation of such plans often involves engineering problems, the cooperation of this bureau is sought in this connection. The bureau now has on hand a large number of designs for buildings and equipment, prints of which are available to those who contemplate building. Descriptive lists of these designs may be had upon request.

There was prepared and issued for the use of college authorities a classified list of the farm-building plans prepared by all the colleges and this bureau. This list enables the authorities to locate and obtain for their own use plans of suitable structures for which they do not themselves have drawings. It also makes it possible for the bureau to refer inquiries from a given State to the agency in that State

from which plans designed to meet local conditions may be obtained. When suitable plans are not available, the correspondent is given the best advice and assistance possible. A scheme of cooperation is now being developed which, it is hoped, will make practicable a complete interchange of such plans as are mutually suitable to the conditions prevailing in two or more of the States, thus avoiding duplication of effort and making available to the farmers of the respective States a much larger choice of plans, at a considerably lower cost to the States and to this bureau for the services rendered.

The increased cost of building has led to a considerable interest in pise de terre, or rammed earth, as a building material. This old type of construction was employed for many years in Europe, and to a very limited extent in this country when transportation facilities were lacking. During the World War its use was revived, especially in England, as a means of meeting the high cost of materials and labor. The use of this method of construction, at least in certain types of buildings, apparently has much to recommend it, but there is lacking exact knowledge as to the kinds of soil best suited to the purpose, the durability of such construction, and the most economical methods of handling the materials. Because of the many requests for information concerning this method of building, a memorandum summarizing the available information was prepared for use in replying to such inquiries.

A new bulletin on farmstead water supply was prepared to better supply the information being requested by an increasing number of farmers concerning this subject. It supersedes an older publication relating to the same general subject, but is more profusely illustrated and includes new material pertaining especially to the planning of the water system for the farm, pumping, and the provision of storage facilities.

For the use of the Office of Cooperative Extension Work, there was prepared lantern slide series No. 105, on farm sanitation, consisting of 33 slides with a syllabus based on a bulletin published previously.

## STUDIES OF THE USE OF TRACTORS

A study of the problems of tractor farming in California has been started in cooperation with the University of California. The types of farming fol-



lowed in California lend themselves very well to the use of tractors. Few crops of the row type are produced, and as a result tractor power can be used for almost all farm operations. Certain soils and climatic conditions that exist in California, however, have produced numerous mechanical difficulties that ordinarily are not encountered in tractor farming. Much of the soil is of a fine gritty nature, and the long dry spells that are common in the West cause an excessive amount of dust to be formed. As a result of these two conditions, very rapid wear occurs in the tractors, and there is extraordinary difficulty in obtaining traction. It is with a view of collecting information that will help solve these mechanical difficulties that the tractor study has been undertaken.

Two bulletins on tractor farming were issued during the year. One is a study of the use of tractors in the winter-wheat belt, and compares the costs of supplying power with horses and with tractors. Comparisons of cost were computed on 1921, 1922, and 1923 values. The other bulletin discusses the utilization and cost of using tractor-drawn implements. It is based on data obtained in tractor investigations previously made, and is intended to be helpful to those who practice power farming or who contemplate a greater use of mechanical power.

### FERTILIZER DISTRIBUTION

The use of high-grade fertilizers is being discussed a great deal at the present time in connection with the disposition of Muscle Shoals, and the Bureau of Soils, the Bureau of Plant Industry, and the Fixed Nitrogen Laboratory have been working for some time on the development of extremely high-percentage fertilizers. If these more concentrated fertilizers prove practical, it will mean the cutting down of the rate of application per acre to as low as one-third and in some cases to one-fifth as much as is now used. There is serious question, however, as to whether the fertilizer distributors now on the market can be successfully operated at these low rates of application. Also, under certain conditions fertilizers now used may cause serious damage when they come in contact with germinating seed and growing plants, and it is possible that such damage will be much greater in case more concentrated fer-

tilizers are used. For these reasons the division of agricultural engineering has been asked to make a study of the mechanical problems of fertilizer distribution, with a view to devising improvements that will handle the small amounts and so distribute the fertilizer as to prevent crop injury. Arrangements are being made to start this work shortly after July 1, 1924.

### ENGINEERING PROBLEMS

By collecting and disseminating the information of an engineering nature secured by other investigators it has been possible to render assistance to thousands of farmers and others confronted with structural, mechanical, and other engineering problems to whom other sources of advice and information are not readily available. This service is rendered largely by correspondence and involves a very large portion of the time of the personnel engaged in agricultural engineering work.

### PUBLICATIONS, EXHIBITS, AND MOTION PICTURES

The educational extension work has been carried on along the same lines as in previous years. Information in regard to the various subjects within the field of the bureau's activities has been laid before the public by means of publications, motion pictures, exhibits, and lantern slides.

New motion pictures have been made of the highway experiments at the Arlington Experiment Farm, tests of guard rails by the Pennsylvania State highway department, and films which will be developed into two 2-reel pictures were made in connection with the highway inspection tour of the Pan American Highway Commission in June, 1924. In the preparation of these pictures the bureau cooperated with the Office of Motion Pictures.

Besides cooperating with the Office of Exhibits in the preparation of models and exhibit booths for exhibition at eligible State fairs and assisting in the demonstration of department exhibits at such fairs, the bureau has prepared special displays for automobile shows and highway conventions. These special exhibits of the bureau are eagerly sought by the largest of the automobile shows, by the American Road Builders' Association for its annual good-roads show at Chicago, and by other highway associations.

Publication of the magazine Public Roads, which was resumed in March, 1924, is the most important development in this field of the bureau's activities. The new publication is a monthly journal of highway research in which it is proposed to publish re-

ports of all researches and tests of the bureau and its cooperators. The four issues published during the fiscal year have been enthusiastically received by highway engineers in this country and abroad.







# REPORT OF THE CHIEF OF THE BUREAU OF SOILS

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
BUREAU OF SOILS,

*Washington, D. C., September 10, 1924.*

SIR: I have the honor to transmit herewith a report covering the operations of the Bureau of Soils for the fiscal year ended June 30, 1924.

Respectfully,

MILTON WHITNEY,  
*Chief of Bureau.*

Hon. H. C. WALLACE,  
*Secretary of Agriculture.*

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## PROGRESS OF THE SOIL SURVEY

During the fiscal year 1924 soil-survey work was carried on in 72 separate projects, 42 of them having been completed during the year. They were distributed over 29 States, all done in cooperation with some State organization. On account of the wide distribution, the survey was enabled to prosecute studies in 8 of the important soil-profile areas of the country. By this policy of wide distribution of projects each year there is presented an opportunity for studying soils under a wide extension of our knowledge of all the important natural soil regions. This is an extremely important matter, since our present information, although very considerable in quantity and reliable in quality, enables us to outline the general features of the great soil groups only and does not permit us either to locate exactly on the ground the boundaries between them or to give the range of their variations in character.

In reference to the latter, it is evident that the results in any area whatever will contribute to our knowledge of these results. With reference to the former, it is evident that the results acquired only in areas near these boundaries will have deciding values.

The work for 1924, in Nebraska, for example, included a group of five counties—Buffalo, Adams, Kearney, Webster, and Nuckolls—located in what is

now thought to be the middle of one of the most important north-and-south belts of soils in the United States. The data assembled have not yet been correlated, but will undoubtedly settle some rather long-standing questions regarding the soils of this belt. Another county in the same State, Platte, will supply data that will be of great value in definitely locating the eastern boundary of this same belt.

Certain peculiar conditions have been known in Wichita County, Tex. They are not confined to that county or even to that State. They are known to exist in many places in the Western States, but in no place are they more typically developed than in Wichita County. The county lies within the same broad belt of soils as that in which the counties referred to in Nebraska lie, and the broad features of the soil profile are identical, but in Wichita County an unusually tough, hard, refractory clay horizon is present, introducing an additional feature and one that is undoubtedly very important from the agricultural point of view in general, and especially so from the point of view of irrigation. A small irrigation project is being discussed for the county, so that this soil feature becomes a very important one. The area has been surveyed and the distribution, character, and relationships of this feature studied and embodied in a report which is now going through the various phases preliminary to publication.

Hidalgo and Milam Counties, in the same State, surveyed, or partly surveyed, during the year, present, each of them its special features, interesting and important from either the scientific or agricultural standpoint, or both. Brown and Douglas Counties, S. Dak., belong in the same soil belt as Wichita County. Thus in the work of the past year opportunity has been offered the survey to study the detailed features in three important places of one of the great soil belts of the country. An important section of this belt—the Kansas section—has never been studied in detail, and until that can be done even our general knowledge of the features of one of the most important soil belts of the world will be lacking in an important respect. The minor details—those that in many cases determine the agricultural importance of a farm or a county—can be obtained only by detailed surveys of the whole belt.

The important north-south soil belt lying west of that in which the counties mentioned lie, extending westward practically to the eastern foot of the Rocky Mountains, was represented by two surveys, one in Montana, the other in the Arkansas River Valley of Colorado. These surveys are bringing out in striking contrast the westward decrease in the content of organic matter in the surface soil and the persistent rise toward the surface of the zone of lime carbonate accumulation in the subsoil.

Another north-south belt, that lying immediately east of the Dakota-Nebraska-Kansas-Texas belt described above, is represented in the year's work by Jackson and Olmsted Counties, Minn., the former lying near the western boundary of the belt. Lac qui Parle County, surveyed during the year, lies just over the boundary within the latter belt. The belt is represented by four counties surveyed in Iowa and a part of Milam County, Tex., the details of soil sections in the latter area differing widely from those in the former areas. The same belt covers eastern Nebraska, northern and western Missouri, eastern Kansas, northern Illinois, and small parts of southern Wisconsin and western Indiana. This is probably the most important single soil area in the United States, its soils being identical with and constituting part of those which grow the surplus corn of the world.

The major soil region, covering the many varieties of light-colored soils,

all free from carbonates and all, with extremely unimportant exceptions, acid in various degrees, occupying the whole eastern part of the United States, is represented by 45 projects distributed over 19 States, the only important agricultural States not represented being Pennsylvania, Virginia, South Carolina, Kentucky, and Louisiana. While this region is covered by soils having in common certain characteristics differing from those of the regions previously referred to, it is made up of three subregions, in each of which the soils have important features not present in any other. These may be designated as a northern, a central, and a southern region.

The northern region is represented by 7 projects, 1 in Minnesota, 4 in Michigan, and 2 in New York. The central region is represented by 21 projects, of which 3 are in Indiana, 2 in Maryland, 2 in Massachusetts (both of which lie practically on the boundary between the northern and central regions), 2 in Michigan, 2 in Missouri, 2 in New Jersey, 1 in New York, 2 in Ohio, 1 in West Virginia, and 4 in Wisconsin. The southern region is represented by 18 projects, 2 of which are in Alabama, 2 in Arkansas, 1 in Florida, 3 in Georgia, 2 in Mississippi, 5 in North Carolina, 1 in Tennessee, and 2 in Texas.

The studies made within the United States have shown the existence of a great number of soil groups differing widely from one another in fundamental characteristics. A comparison of these groups with those discovered in other parts of the world seems to show conclusively that there are, within the boundaries of continental United States a greater number of well-defined and widely differing soil groups than can be found in any other single country in the world, with the possible exception of Russia, including European and Asiatic Russia. This is a mere possibility, however, and will probably prove to be no exception.

Notwithstanding this extremely wide range of soil characteristics, it has long been known that we do not have, in this country, representatives of all the possible soil groups in the world, even of those that are extremely important. For example, no part of our country extends into the Tropics, at least in sufficient area to warrant the drawing of conclusions as to the characteristics of tropical soils from soil studies carried on here.



Studies of soils in the field, those studies that are the peculiar function of the Soil Survey, have been much more extensive in this country than in any other country in the world. It has long been accepted as a fundamental principle in this bureau that we are under obligation to obtain as broad a knowledge of the soils of the world as possible.

This position has been assumed partly because of our relation to the science as a whole and partly because of the tremendous importance of the agricultural industry in this country.

### RUBBER SOIL INVESTIGATIONS

For many years, therefore, the bureau has been on the lookout for an opportunity to study tropical soils. The opportunity came in the request made by the Department of Commerce, in June, 1923, for cooperation between that department and the Department of Agriculture in the study of the natural conditions under which rubber trees are growing in the various countries of South and Central America, the Philippines, and the East Indies. Three men from the regular force of the Soil Survey were assigned to this work. Each of them undertook the work with two distinct aims in view. One of these was the study of the relation between the soil and the successful growth of rubber trees, either in the native forests or in plantations, and the other was the study of tropical soils for the purpose of determining their fundamental characteristics. Studies were carried on in all of the Central American countries south of Mexico; in Colombia, Ecuador, Peru, Bolivia, and Brazil in South America; and in the Philippines, Borneo, Sumatra, the Federated Malay States, and India. A very large quantity of data was assembled, including many soil samples and photographs. The reports for the Department of Commerce have been prepared, and the study of the material from the scientific standpoint is in progress. Enough data have been accumulated to determine the relation of tropical climates to the development of laterite and to the various kinds of rocks in the various regions studied. The whole question of the varying relations of climatic, topographic, and geologic features to the evolution of soil profiles will undoubtedly be clarified when the material has been worked up.

### POSSIBLE EXTENSION OF COTTON, CORN, AND WHEAT PRODUCTION IN SOUTH AMERICA

The outstanding importance of the cotton, corn, and wheat crops in the United States makes it very desirable to know the extent throughout the world of the conditions under which these crops are being grown, and the probable extent to which the expansion of the area devoted to them may be possible in the future, in so far as that is controlled by natural conditions. It has long been recognized as desirable that studies be made of the soil conditions existing in the various regions where the climatic conditions seem to favor the growing of such crops. Two years ago some studies were made of the possibilities of the expansion of wheat and corn acreage in the various countries of southeastern Europe, but no opportunity to study the possibilities of an expansion of the cotton acreage of the world was presented until a year ago. An arrangement was then entered into between the Bureau of Soils, through the department, with the American Geographic Society, by which the society agreed to bear a very important part of the expenses of sending a representative of the Bureau of Soils to Brazil for the purpose of spending a short time in studying the regions in which cotton is now being grown and the regions where the soil conditions seem to favor an extension of the present acreage. The arrangement included also a study of the corn and wheat producing regions of Argentina.

A representative of the bureau was assigned to this work in January. A large area of country was traversed and a great deal of data assembled. Examination and correlation of this material in the laboratories and work-rooms of the bureau is now being pushed forward as rapidly as time and other duties permit.

Tables 1 and 2 summarize the work of the Soil Survey during the last fiscal year. They also present a recapitulation of areas surveyed since the inception of the work in 1899. Surveys covering 27,306 square miles in detail and 9,885 square miles in reconnaissance were completed during the year ended June 30, 1924, and the total since the survey was begun reached 1,220,296 square miles, of which 657,053 square miles was detailed and 563,243 reconnaissance.

TABLE 1.—*Individual areas surveyed and mapped during the fiscal year ended June 30, 1924*

## DETAILED

State	Area	Area surveyed	
		Square miles	Acres
Alabama.....	Cherokee County.....	1 425	272,000
	Franklin County.....	146	93,440
Arkansas.....	Bradley County.....	1 353	225,920
	Nevada County.....	1 149	95,360
California.....	Auburn area.....	408	261,120
	Bishop area.....	86	55,040
	King City area.....	1,093	699,520
Colorado.....	Lower Arkansas Valley area.....	128	81,920
Florida.....	Lake County.....	178	113,920
Georgia.....	Chattahoochee County.....	218	139,520
	Fannin County.....	401	256,640
	Randolph County.....	412	263,680
Idaho.....	Minidoka area.....	1 184	117,760
	Soda Springs-Bancroft area.....	98	62,720
Indiana.....	Jasper County.....	196	125,440
	Steuben County.....	305	195,200
	Wayne County.....	377	241,280
Iowa.....	Appanoose County.....	513	328,320
	Clarke County.....	428	273,920
	Harrison County.....	1 567	362,880
	Plymouth County.....	1 750	480,000
Maryland.....	St. Marys County.....	371	237,440
	Worcester County.....	284	181,760
Massachusetts.....	Berkshire County.....	966	618,240
Michigan.....	Antrim County.....	475	304,000
	Ingham County.....	553	353,920
	Isabella County.....	572	366,080
	Livingston County.....	578	369,920
	Macomb County.....	472	302,080
	Ogemaw County.....	580	371,200
Minnesota.....	Jackson County.....	702	449,280
	Lac qui Parle County.....	253	161,920
	Lake of the Woods County.....	439	280,960
	Olmsted County.....	1 329	210,560
Mississippi.....	Harrison County.....	1 274	175,360
	Jackson County.....	1 69	44,160
Missouri.....	Lawrence County.....	1 381	243,840
	Phelps County.....	322	206,080
Nebraska.....	Adams County.....	565	361,600
	Buffalo County.....	732	468,480
	Kearney County.....	516	330,240
	Nuckolls County.....	97	62,080
	Platte County.....	673	430,720
	Webster County.....	578	369,920
New Jersey.....	Camden area.....	157	100,480
	Freehold area.....	270	172,800
New York.....	Columbia County.....	644	412,160
	Herkimer County.....	1 141	90,240
	St. Lawrence County.....	404	258,560
North Carolina.....	Greene County.....	252	161,280
	Northampton County.....	170	108,800
	Polk County.....	251	160,640
	Rutherford County.....	381	243,840
	Wilson County.....	234	149,760
North Dakota.....	Cass County.....	1 484	309,760
Ohio.....	Clermont County.....	465	297,600
	Madison County.....	1 83	53,120
Oregon.....	Linn County.....	1 568	365,520
South Dakota.....	Brown County.....	229	146,560
	Douglas County.....	435	278,400
	Walworth County.....	742	474,880
Tennessee.....	Hardin County.....	177	113,280
Texas.....	Henderson County.....	1 205	131,200
	Hidalgo County.....	528	337,920
	Milam County.....	155	99,200
	Nacogdoches County.....	294	188,160
	Wichita County.....	1 435	278,400
West Virginia.....	Mercer County.....	419	268,160
Wisconsin.....	Monroe County.....	1 424	271,360
	Pierce County.....	1 310	198,400
	Sauk County.....	171	109,440
	Sheboygan County.....	82	52,480
Total.....		27,306	17,475,840

<sup>1</sup> These figures do not include portions of these areas surveyed in preceding years.

TABLE 2.—Areas surveyed and mapped in the several States during the fiscal year ended June 30, 1924, and the areas previously reported

State or Territory	Work during 1924 (square miles)	Work previously reported (square miles)	Total	
			Square miles	Acres
Alabama.....	571	49,459	50,030	32,019,200
Arizona.....		1,738	1,738	1,112,320
Arkansas.....	502	14,643	15,145	9,692,800
California.....	1,587	23,496	25,083	16,053,120
Colorado.....	128	3,038	3,166	2,026,240
Connecticut.....		1,704	1,704	1,090,560
Delaware.....		2,276	2,276	1,456,640
Florida.....	178	12,206	12,384	7,925,760
Georgia.....	1,031	28,736	29,767	19,050,880
Idaho.....	282	9,091	9,373	5,998,720
Illinois.....		6,770	6,770	4,332,800
Indiana.....	878	13,699	14,577	9,329,280
Iowa.....	2,258	31,410	33,668	21,547,520
Kansas.....		9,456	9,456	6,051,840
Kentucky.....		5,020	5,020	3,212,800
Louisiana.....		15,597	15,597	9,982,080
Maine.....		2,197	2,197	1,406,080
Maryland.....	655	9,914	10,569	6,764,160
Massachusetts.....	966	4,436	5,402	3,457,280
Michigan.....	3,230	8,500	11,730	7,507,200
Minnesota.....	1,723	5,885	7,608	4,869,120
Mississippi.....	343	27,034	27,377	17,521,280
Missouri.....	763	35,748	36,451	23,328,640
Montana.....		882	882	564,480
Nebraska.....	3,161	35,097	38,258	24,485,120
Nevada.....		652	652	417,280
New Hampshire.....		1,411	1,411	903,040
New Jersey.....	427	9,028	9,455	6,051,200
New Mexico.....		596	596	381,440
New York.....	1,189	22,056	23,245	14,876,800
North Carolina.....	1,288	35,275	36,563	23,400,320
North Dakota.....	484	16,121	16,605	10,627,200
Ohio.....	548	10,789	11,337	7,255,680
Oklahoma.....		6,540	6,540	4,185,600
Oregon.....	568	9,228	9,796	6,269,440
Pennsylvania.....		16,721	16,721	10,701,440
Porto Rico.....		330	330	211,200
Rhode Island.....		1,085	1,085	694,400
South Carolina.....		23,062	23,062	14,759,680
South Dakota.....	1,406	3,966	5,372	3,438,080
Tennessee.....	177	10,616	10,793	6,907,520
Texas.....	1,617	40,782	42,399	27,135,360
Utah.....		2,419	2,419	1,548,160
Vermont.....		1,175	1,175	752,000
Virginia.....		9,713	9,713	6,216,320
Washington.....		10,752	10,752	6,881,280
West Virginia.....	419	18,577	18,996	12,157,440
Wisconsin.....	987	19,966	20,953	13,409,920
Wyoming.....		855	855	547,200
Total.....	27,306	629,747	657,053	420,513,920

## RECONNAISSANCE

Alaska.....		31,915	31,915	20,425,600
Arkansas-Missouri.....		58,000	58,000	37,120,000
California.....		32,135	32,135	20,566,400
Kansas.....		39,960	39,960	25,574,400
Michigan.....		1,322	1,322	846,080
Minnesota.....		752	752	481,280
Montana.....	6,460	12,470	18,930	12,115,200
Nebraska.....		53,064	53,064	33,960,960
North Dakota.....		39,240	39,240	25,113,600
Ohio.....		41,420	41,420	26,508,800
Pennsylvania.....		41,405	41,405	26,499,200
South Dakota.....		41,400	41,400	26,496,000
Texas.....		132,735	132,735	84,950,400
Washington.....	3,425	13,115	16,540	10,585,600
Wisconsin.....		14,425	14,425	9,232,000
Total.....	9,885	553,358	563,243	360,475,520



## DEVELOPMENT OF SOIL SCIENCE

The Soil Survey has now been in existence about 25 years. It has been primarily an institution for accumulating facts. This was necessarily a preliminary to the formulation of general principles or the drawing of conclusions. Since a work of this character had not been undertaken in any other country up to the time it was started here, it became necessary also to develop methods of conducting the work and to assume a point of view. This has required time and thought, but it is now fully recognized that these things could not by any other method have been done as well as they have been done. Learning how best to do a thing by actually doing it is a recognized method of human procedure.

The time has now been reached when at least preliminary generalizations may be made. While many gaps still exist in our knowledge, it is thought that these may be filled more intelligently and satisfactorily if done under the influence or inspiration of a knowledge of tentatively expressed general principles whose establishment or rejection will be brought about by the filling of these gaps.

The soil survey has developed into an institution that does much more than what was thought necessary many years ago, and what is not yet thought necessary by many persons who have never given the matter of soil surveying more than perfunctory consideration. It seems to have been thought by many persons that in some mysterious way the things called soils, the things placed on a soil map, were well defined, their characteristics tangible, all clearly exposed to view, and so clearly labeled that anyone who had taken a course in college could recognize them at once; that soil surveying was merely a matter of getting out on the land, observing the well-defined earmarks of the individual soils, and placing the boundaries of each kind on a map, doing it as a matter of routine and without the exercise of much judgment or comprehensive thought. It was taken for granted that all the soil man needed to do was to determine the coarseness or fineness of grain of the soil and the geological formation under it.

Viewing this from our present position, one is inclined to feel considerable astonishment that such a situation really existed so short a time ago in reference to a natural body that constitutes the most important natural resource that man has ever had or still

has to deal with, but on second thought the reason is clear to anyone familiar with the history of soil investigation. To the layman it is difficult to believe that the accumulation of actual knowledge of soil characteristics was so insignificant in total amount up to so recent a period. To the specialist, however, the fact has become commonplace and no longer causes any surprise.

To him it has become an accepted fact that up to the last quarter of the nineteenth century the study of soils, as such, had not been begun. Chemical analyses and pseudo-chemical analyses of bodies of dirt had been made in great number, but these had been collected with no reference whatever to, and by men who had no knowledge of, the characteristics or parts of the soil from which they had been collected.

In the United States systematic study of soil characteristics in the field, the only place where such studies can be carried on, was begun just before the close of the nineteenth century. It is a matter of no surprise, when the knowledge of soils then existing is taken into consideration, that it was begun with the assumption that the determination of the texture of the surface 6-inch layer and the geology of the underlying material constituted the proper method of attack.

A very short period of actual contact with the soil brought to light, however, many soil features that could not be brought into harmony with pre-existing assumptions. It soon became evident that the fundamental work to be done was the accumulation of a great fund of actual soil knowledge by means of the study of the soil as it actually exists in its many manifestations.

This policy has existed from that time to the present with increasing emphasis on the fundamental importance of soil knowledge, owing to the accumulating evidence that reliance must be placed on this rather than on any assumed relation of soil character to geology, physiography, climate, natural vegetation, or any other force or condition outside the soil itself.

The wealth of knowledge thus accumulated and still accumulating has brought with it its problems and entailed its peculiar obligations, the most important of which is that of weighing the facts and determining their relative importance. This has required necessarily a great deal of time and thought.

Without undertaking even to outline the various steps in the progress that has been made in the handling of this great accumulation of data, it may be stated that the result shows that the whole accumulation may be organized and made available by grouping it into and around what has been recognized as the soil section or soil profile. The accumulated data have shown that the whole nature of the soil may be expressed through the features of the soil sections. The soil has been shown to consist of parts, and all features must refer to these parts rather than to the soil as a whole. Just as the earth's crust consists of formations, so does the soil consist of horizons, and these are features characteristic of the soil itself and not inherited from the parent material from which it has developed. Just as an organic body is made up of organs, the soil is made up of horizons. The soil has an organized or regular construction that may be compared to the anatomy of organic beings.

The importance of the profile in all soil studies has recently received international recognition in the adoption, by one of the important international committees at the International Congress of Soil Scientists at Rome last May, of a resolution pledging the members in all countries to the prosecution of soil studies through the features of the soil profile or section.

The study of soils through the profile, mainly in this country, and also in Russia and Rumania, has brought out another fact of extensive occurrence and significant character. It has developed that not all the soils in a given region have identical profiles, but the significant feature about it is that the lack of identity consists not in character but in degree of perfection in the expression of one fundamentally uniform profile. This has been interpreted to mean that in any locality the soils may exist in various stages of development in the same way that the plants of a given region may consist of those that are fully developed or mature, those that are half mature, and those still very immature. In other words, soils pass through a series of stages in their development, the stages being marked by the relative perfection of the soil profile or section in each. In this sense soils are mature and immature or normal and subnormal and possibly supernormal.

This characteristic of passing through a series of stages in a progressive course of development has

become in recent years a fact of general acceptance in the soil survey in this country, but the first clear, well-defined recognition in a foreign country is to be found in a paper submitted by Prof. Alfred Till, of Vienna, to the recent International Congress of Soil Scientists at Rome.

The accumulation of soil facts assembled by the Soil Survey has furnished the basis for still other generalizations of undoubted scientific importance and probably of great practical value.

A comprehensive study of the great accumulation of soil sections now on file in the records of the Soil Survey indicates very strongly that the soil profiles of the well-drained, normally developed soils of the whole country consist of three fundamentally different layers or horizons, which in general may be designated as (1) a surface horizon of elimination, a horizon from which mineral material is being constantly removed during the course of soil development; (2) a horizon beneath it of concentration, one into which material is concentrated during the progress of soil development; and (3) a deeper horizon which has suffered no fundamental change, consisting of the slightly changed or the wholly unchanged parent geological formation. Studies made by Russians in Russia had suggested the same conclusion, and the results in this country, covering a much wider range of soil characteristics, confirm their conclusions. These horizons are designated as the A, B, and C horizons, respectively.

On the basis of the characteristics of soil profiles the soils of the United States may be grouped into two major groups, corresponding roughly to the major grouping of animals, on the basis of the soil section, into (1) those in which oxides of silica and sesquioxides of alumina and iron accumulate in the soil during the progress of soil development; (2) those in which carbonates and other relatively easily soluble compounds of the alkalies and alkaline earths accumulate.

Each of these groups is found to consist of several subgroups, each characterized by the prevalence throughout all its members of a profile with the same general features, the number of points of agreement being greater than the single point on which the members of the two major groups are united. The members of the first major group consist of:

(1) Soils in which sesquioxides of iron and alumina and certain forms of organic matter are removed from the



A horizon and concentrated in the B horizon with less extensive but noticeable concentration of alkalies and alkaline earths in the same horizon but relatively slight elimination of the latter substances from the soil as a whole.

(2) Soils in which sesquioxides of iron and alumina are removed from the A horizon and concentrated in the B horizon with moderate accumulation of alkalies and alkaline earths as in the first group, along with the mechanical concentration of fine earth from the A to the B horizon.

(3) Soils in which the processes of soil development have been the same as in 2, the same results effected with reference to the fine earth and sesquioxides, but in which there has also been an extensive removal from the whole soil of alkalies and alkaline earths.

It has not only been determined that the soils of the region named above may be thus grouped, but it has been found that each group dominates a given section of country and has therefore not merely taxonomic significance but geographic significance as well, and without question will be found to have agricultural significance when correlation studies can be made.

The shifting of attention in field soil study from the geological formation to which it was directed up to the beginning of the twentieth century, and from the climatic features where it was temporarily directed not many years ago to the soil profile, has been of great importance in other directions than those outlined above. One of its most important results has been the direction of attention directly to the soil itself rather than to some force, feature, or condition outside the soil which was or may yet be assumed to have had some influence in the development of the soil. It may safely be stated that the beginning of this shift was the beginning in the development of a real science of the soil.

Another important result of the shift has been the influence of actual soil study in the determination of the depth to which observations should extend. In the early work of soil surveying in this country the depth was arbitrarily limited to 3 feet, regardless of the nature of the soil. This was based on the supposed depth to which plant roots extend into the soil. This, it will be seen, is another case of making soil surveys on the basis of those facts, forces, or conditions outside the soil itself, in this case agriculture. At the present time,

under the influence of the principle of soil study for soil surveys, the soil is examined throughout its whole thickness, whatever that may be, and in addition to this the upper part of the underlying parent material is examined also. There has been a constant effort to release the soil student from any sort of arbitrary limitations to the freedom of his observations.

It should be stated here that the results above outlined could not have been obtained in so short a time, had not the chief of the bureau at an early date adopted the policy of distributing over a wide geographic area the projects to be worked each year. By this policy it has been possible to study the soil profile over a wide area of country and under a wide range of conditions in a relatively short period of time. The same general principles could not possibly have been established in so short a time had the survey been begun in one area and spread outward from there, covering the country in a single sweep.

#### CHEMICAL DIVISION

The work of the chemical division, as in previous years, has necessarily been apportioned between the examination of particular soils by established methods, and the determination of new general facts which will lead to a more precise knowledge of all soils and to improved methods of soil examination. The past year has been fruitful in both lines of inquiry.

Chemical determinations have been made on a large number of virgin and cultivated soils of the Tropics and of the continental United States. A better knowledge of the chemical characteristics of broad groups of soils has been gained and several extreme soil types have been encountered. The chemical data supplement field observations on the different soils in showing the course which the soil-forming processes have taken in the different types, and they form one of the criteria of soil classification. In connection with the rubber investigations, analyses have been made of soils from South America, Central America, and the Philippines. Many soils received from other governmental units and from farmers have been examined for special constituents.

Investigations of the chemistry of the soil in general have been concentrated largely on the colloidal material of the soil. The earlier work of the bureau on this subject was concerned chiefly with methods of iso-



lating the colloidal material from the other soil particles and with methods for determining the total quantity of colloid present in the soil. The solution of these problems yielded valuable information and at the same time paved the way for further investigations.

The total quantity of colloidal material in the soil has been estimated by several adsorption methods, by extraction combined with microscopical observation, and by heat of wetting determinations. Descriptions of these methods and of the results obtained have been published in a bulletin and in journal articles. The widely different methods of estimation yield results that agree fairly well on the whole. In the case of certain soils, however, the methods lack the accuracy desired. Conditions tending to produce inaccuracies in the results are being investigated and it is expected that further study of the properties of the colloidal material will disclose a means of correction. On applying these methods to numerous soils it was found that soils in general contain very much more colloidal material than had hitherto been thought. It is, therefore, necessary to revise our views of the soil.

A study of the chemical compositions of the colloidal materials present in certain important agricultural soil types was completed the last year and is being published as a bulletin. While the different colloidal materials examined have a wide range of chemical composition, the colloids extracted from several distinct soil types are very similar in composition. Some correlation is apparent between the composition of the colloids and the annual precipitation to which the soils are exposed. Conditions determining the compositions of the various colloids are suggested by this work. A thorough knowledge of such conditions would aid in the classification of soils and in a better understanding of the relationships of different soils with respect to productivity.

Various attempts were made to determine the combinations of the elements, or their conditions, in the colloidal material, but conclusive evidence was not obtained. This problem has defied solution for many years in the case of somewhat similar but much simpler colloids, such as colloidal minerals and certain synthetic gels. Conclusive evidence was obtained that the bulk of the colloidal material in most soils is not made up of fine particles of the common soil-forming

minerals, but rather of the decomposition products of these minerals. It is, therefore, apparent that the colloidal material is a quite distinct part of the soil, differing from the sand and silt particles in chemical nature as well as in size and in the exaggeration of those properties attending great increases in surface.

Considerable progress has been made in determining the physicochemical properties of the more distinctive types of colloidal materials thus far encountered, and a report of this work will probably be prepared the coming year. Pronounced variation has been found in the heat of wetting, swelling, viscosity, size of particles, electrical properties, etc., of the different types of colloids. Moreover, these differences appear to be related in some degree to differences in the chemical compositions of the colloidal materials.

Although the investigations of the colloidal material in soils already completed have established many new facts and given us a new insight into the soil, enabling us to understand more clearly many soil phenomena that were heretofore obscure, this field of study has merely been scratched. We are endeavoring to study the soil colloids as colloids, to determine the chemical and physical reactions exactly before applying the facts discovered to practical soil problems. There has been a tendency in the past to apply colloid chemical ideas to soil problems and use colloid chemical explanations of soil phenomena before anything specific was known about the colloidal material in the soil or its behavior. This did not get us very far. It is, of course, possible to operate certain machines without understanding their mechanisms. But in order to repair or improve a machine it is necessary to know its parts and how they are interrelated.

Having participated in the development of soil science for more than 30 years, I may be allowed the privilege of prediction. It seems to me that the study of soils from the standpoint of colloid chemistry will result in another period of rapid growth in soil science, such as followed on the recognition of microorganisms in the soil and on the realization that soils are dynamic in nature rather than static.

### SOIL PHYSICS

The physical condition of the soil is recognized as of great importance in tillage operations and probably is equally as or more important than the

weather in the production of most crop plants. High soil temperatures, for instance, are likely to cause increased root development, just as high atmospheric temperature under similar conditions may promote heavy foliage growth. The presence of abundant water in the soil is one of the conditions requisite for complete plant development.

The physical properties of a soil are influenced by the relations of four classes of materials of which the soil is composed: The solid matter including the organic material; the colloid, derived from mineral decomposition; the soil solution or moisture; and the soil atmosphere. The condition of the soil is closely related to the changes in these materials. A study of the properties of these materials brings out the relation of one to another and the underlying principles for the control of soil conditions.

Recent advances in soil work in this bureau have shown the colloid portion of the soil frequently to be the determining factor in soil condition. It is the portion of the soil responsible for virtually all gas absorption. It causes the retention of soluble salts and it regulates the moisture conditions of the soil. A method of determining the amount of colloid has enabled us to include this determination in the mechanical analysis of the soil. This gives a picture of the soil composition and furnishes a better understanding of the relative amounts of the different sized mineral grains and of colloid. The colloid portion influences the tilth of the soil through its aggregation, producing a soil of good or bad condition, depending on whether there is much or little aggregation.

A study of the binding power of soils has shown a greater binding power with larger amounts of colloid present and a relationship between the two has been established. These results may have application in work involving this property of the soil, such as in the building of earth dams, in road construction, and in tillage operations.

A constituent showing the properties of a colloid must exercise profound influence on the moisture conditions of the soil, and the relation of colloid content to moisture movement is being studied. The expansion and contraction of colloid with the gain or loss of water not only has an effect on the soil structure, but must exert a strong influence on the movement of water through the soil. One phase

of this is being studied by investigations of the rate of percolation through sand with varying amounts of colloids. It has been found that the different colloids affect the percolation rate to different extents, but that for each colloid there is a definite percentage in the mixtures which causes the minimum percolation in the soil.

Soil-temperature records are being collected to determine the diurnal and seasonal changes taking place throughout the year. These records will be continued for several years and the factors influencing soil temperatures studied.

Mechanical analyses have been made of soil samples collected by the Soil Survey and by special investigators examining the soils of Central and South America and the Philippines. On several hundred of these soils, examined for their suitability for rubber culture, more complete physical examinations have been made, including determinations of the colloid content and the moisture equivalents. Numerous samples of material have been examined for the Bureau of Public Roads, the Geological Survey, and other offices of the Government, to furnish them data in determining suitability and treatments for drainage, irrigation, road building, and various purposes.

## FERTILIZER RESOURCES

Researches pertaining to fertilizer resources may be described as applying principally to two general phases of the problem—those designed to effect improvement in the extraction of fertilizer ingredients—potash, phosphoric acid, and ammonia—from raw materials by methods representing enhanced economies—technology of extraction; and those pertaining to improved methods of combining the refined ingredients, to yield mixtures highly concentrated in essential elements in form entirely available, easily and economically manipulated, stored, transported, and applied—concentrated fertilizers.

### AMMONIA

Since the relinquishment of the collaborative arrangement between this division and the Fixed Nitrogen Research Laboratory the investigations of ammonia here conducted have been confined to organic ammoniates, principally trade wastes. New sources of ammoniates have been sought and efforts made to develop present known



sources through improved technology. For example, cocoa press-cake, a by-product of the cocoa industry, has been found to be available in important quantity, and its composition is such as to offer promise of its becoming a valuable addition to the supply of commercial ammoniates.

Work on the recovery of fertilizer material from the animal wastes from small-scale slaughter has been continued during the last fiscal year, and additional experimental data on composting and fat rendering under farm conditions have been secured.

### PHOSPHORIC ACID

The present trend within the fertilizer industry toward the manufacture and use of concentrated fertilizers makes phosphoric acid the keystone of the situation. Under present conditions and for many years past that essential element of plant food has constituted the greater part of the elements in mixed fertilizers.

The phosphoric-acid investigations of this bureau were designed primarily to decrease the losses now entailed at the phosphate mines through the use of imperfect methods of concentration. There are instances where this loss is equivalent to 50 per cent of the values mined. High transportation costs and the requirements of the export business so largely engaged in by the phosphate mining industry offer no escape from the necessity of carrying concentration of the phosphate rock to the highest practicable degree.

Methods have been developed in this division whereby the run-of-mine rock may be treated for the volatilization of its phosphoric acid, first in the electric furnace, subsequently in the fuel-fired furnace; and now as a result of recent investigations it is found that a temperature as low as 1,300° C. may be made to suffice, provided reducing conditions are maintained. At such low temperatures the mixture does not fuse to form a slag, but remains entirely pulverulent, a fact of great importance as radically changing and greatly facilitating furnace operations. Furthermore, it is found that potash silicates may be freely substituted for sand as a constituent of the charge and the potash therefrom simultaneously volatilized and recovered with the phosphoric acid. The first two methods have already been adopted and put into commercial application by important industrial concerns. These methods, undergoing progressive improvement, yield phosphoric

acid of 80 to 100 per cent concentration, where formerly and conventionally it entered the market as 16 per cent goods. The costs of volatilization at the present stage of these researches compare favorably with those involved in the present manufacture of acidified phosphate rock.

Emphasis should be placed on the potential value of phosphoric acid to agriculture through its use as an industrial chemical reagent as a substitute for sulphuric and other acids in those applications where soluble phosphates useful for fertilizer purposes are yielded as by-products. In the manufacture of hydrochloric acid, for example, from sodium chloride and sulphuric acid, the residue, sodium sulphate, is of only slight value, while, if phosphoric acid be used, the residue sodium phosphate, may have a value, per unit of phosphoric acid contained, approximately equal to that of the acid employed. Or, one may proceed a step further, substituting potassium chloride for the sodium salt and thus obtain a residue containing both potash and phosphoric acid.

In the recovery of ammonia as a by-product of the coking of coal, sulphuric acid is employed, with the production of ammonium sulphate containing 24 per cent plant food. If phosphoric acid be substituted ammonium phosphate results containing 76 per cent plant food. Sulphuric acid makes no contribution in this instance to the rated fertilizer value of the product. Its use therefore represents a cost for which there is no recompense. If phosphoric acid be substituted, on the other hand, the increased value of the product neutralizes the cost of the acid, and the product may be cheapened accordingly.

These illustrations of the great potential value of phosphoric acid in industries may be multiplied, and the detailed technology of such application is under active investigation in this bureau.

### POTASH

Surveys of the Nation's resources in potash show that vast quantities of that essential commodity are available from two general classes of raw materials, viz, those yielded as waste products of present industries and those represented by natural deposits of potash salines and minerals. For example, surveys of the cement, the blast-furnace, and the distilling industries now completed show an amount



of potash there thrown away annually approximately equal to our present importations from European countries, and the amounts potentially available from that perennial source, the kelps of the Pacific coast—methods for the recovery of which have been completely demonstrated—and from the saline lakes of the West and the minerals, such as the alunites of Utah, the greensands of New Jersey, the leucites of Wyoming, and the shales of Georgia, are practically unlimited and inexhaustible and are capable of supplying potash for American agriculture in constantly increasing amounts for an indefinite period. The technology of extracting potash from these sources is being studied with a view to so cheapening the processes of extraction that potash industries may be established on the basis of all of them, as they have already been on several of them, largely as a result of the work of this bureau.

Potash industries are now established as parts of the cement, the borax, and the distilling industries, and are operating successfully in spite of the most severe competition ever experienced at the hands of the European industry.

The various industrial wastes and raw materials represent concrete problems too numerous to be placed under immediate investigation simultaneously with present restricted facilities; but the more important ones are being investigated with very encouraging results, and a new process here developed for the extraction of potash from that largest of all present known sources, the greensands, offers the promise of an additional industry established on that practically inexhaustible raw material.

In the potash researches conducted by this bureau special emphasis is being placed on by-product, for it is realized that only by the simultaneous extraction of other values can the production of potash from present known sources be accomplished profitably. The very substantial progress now being made is attributable to this point of view. Results now in hand appear to justify the belief that the potash now yielded but lost from the major industries where produced will be saved and made available for agriculture, and furthermore that the major silicates will shortly be placed under active commercial exploitation through methods developed largely in these laboratories.

In these investigations attention is given the important consideration that

potash in the future should be yielded in that form which makes its combination in concentrated fertilizers both convenient and economical. Thus it should be yielded as phosphate or nitrate or in some form readily convertible into these.

### CONCENTRATED FERTILIZERS

The combination of the foregoing three essential ingredients of commercial fertilizers—ammonia, phosphoric acid, and potash—to form salts or mixtures of salts made up exclusively of acids and bases of direct fertilizer value constitutes the main problem in connection with the investigation of concentrated fertilizers. With phosphoric acid as the basis, salts such as ammonium phosphate and potassium phosphate are produced and mixed to form a complete fertilizer. To vary the mixture to suit any requirement, potassium nitrate and ammonium nitrate are added. Thus mixtures are obtained, heretofore impossible, carrying as high as 85 per cent plant food where conventionally mixed fertilizers contain only 12 to 16 per cent plant food. It is obvious at a glance what great savings are thus made possible in handling, sacking, and transportation costs, cheapening the commodity to the farmer and widening the territory where it may be economically applied.

In detail, the absorption of gaseous ammonia by phosphoric acid to form crystalline ammonium phosphate; equilibria between gaseous ammonia and ammonium phosphates; the treatment of potassium chloride with phosphoric acid to form potassium phosphate with the volatilization and recovery of hydrochloric acid; the absorption of nitric acid in solutions of potassium chloride with a view to the direct formation of potassium nitrate; the equilibria obtainable in the system  $KCl$ ,  $HNO_3$  and water; the physical properties of the salts thus obtained and of the various mixtures, their solubilities, their reactions when mixed, and their behavior on storage, represent some of the phases of this problem now under investigation.

Following a detailed study of the chemistry and technology of the manufacture of these concentrated fertilizers collaboratively with other divisions of the department, field tests are now being organized to demonstrate the optimum conditions for their application, the quantities, mixtures, methods, and machinery for distribution and effects on crop yields. Thus

will be bridged the gap in definite information which now exists between the factory and the farm, and here will be answered the question whether these compounds may be applied directly as manufactured or, before being applied, should be mixed with diluents in factories, cooperative mixing plants, or on the farm.

#### OTHER SOIL AMENDMENTS

The agricultural importance of various other materials besides the three substances, ammonia, phosphoric acid, and potash, regarded as essential and generally employed—such as, for example, sulphur in its various applications, lime, gypsum, magnesia, and manganese—is rapidly winning recognition. Some of them are invaluable

as corrective agencies, while others are essential to meet soil deficiencies. Their consideration must be included in any broad study of fertilizer problems.

Numerous publications have appeared during the year on various phases of the foregoing investigations and reports rendered on these and collateral subjects.

An active information service has been maintained to furnish farmers and others technical information regarding mixed fertilizers and their ingredients, agricultural lime and sulphur, and manures, their origin, the sources of supply, their manufacture, prices, and mixing. The bureau as a whole has maintained collaborations with other governmental enterprises where opportunity has been offered.









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**REPORT OF THE SOLICITOR**

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UNITED STATES DEPARTMENT OF AGRICULTURE,  
OFFICE OF THE SOLICITOR,  
*Washington, D. C., September 10, 1924.*

SIR: I submit herewith report of the work of the Office of the Solicitor for the fiscal year ended June 30, 1924.

Respectfully,

R. W. WILLIAMS, *Solicitor.*

Hon. HENRY C. WALLACE,  
*Secretary of Agriculture.*

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Notwithstanding the enactment by Congress during the preceding fiscal year of several regulatory statutes committed to the Secretary of Agriculture for administration, which, as stated in the last annual report, would inevitably increase the work of this office, it is a pleasure to report that no additions were made in the personnel of the office. And notwithstanding the enactment by Congress at its last session of a number of new laws for administration by the department, it does not now appear to be necessary to employ additional assistance in the office. On the contrary, it is hoped and expected that some slight reduction in our force may be possible during the coming year.

The already long list of regulatory statutes administered by the department was augmented at the last session of Congress by the enactment of the so-called McNary-Clarke forestry law (43 Stat. 653); the Upper Mississippi River wild life and fish refuge law (43 Stat. 650); the amendment of the Alaska game law (43 Stat. 668), conferring upon the Secretary of Agriculture all the powers and duties of the governor of Alaska under the existing Alaska game law; the New Mexico farmers' relief law (43 Stat. 110); and the amendment of section 84 of the Penal Code (43 Stat. 98), extending the provisions of this section to animals, as distinguished from birds, on the department's bird reservations, and making it a crime wilfully to injure, molest, or destroy any property of the United States on such reservations.

The revision of the compilation of laws applicable to the Department of

Agriculture, which has been in progress for some time past, was completed near the close of the year and is in the process of printing. This compilation will include all the laws applicable to the Department of Agriculture in force and will be exhaustively indexed. Use of the original compilation of laws has been very much hampered by the lack of such an index and so no efforts have been spared in the revision to provide an index that will make anything in the book easily available to the workers in the department and those on the outside who may have occasion to refer to it.

At the request of the Forest Service an exhaustive study of the constitutions of all the States was made to ascertain their provisions bearing upon taxation of forest lands, and the Forest Service was advised with reference thereto. At the request of the Bureau of Agricultural Economics, a compilation was made and furnished that bureau of the laws of all the States relating to cold storage, and a paper on cold-storage legislation was prepared by one of the assistants in the office for presentation at the London meeting of cold-storage interests.

The solicitor appeared before the House Committee on Agriculture to explain the reasons for the amendment of several existing statutes and the enactment of additional law, recommended to Congress by you at its last session.

One of the lawyers in the office was detailed for approximately two months to the department's seed-loan office at Grand Forks, N. Dak., to assist the administrative officials there in the



collection of loans made pursuant to the two acts of Congress providing for such loans.

In effectuation of the department's endeavor to eliminate from the market adulterated canned salmon, one of the assistants in the food and drugs section of the office attended and participated in the trial of the stubbornly contested cases instituted under the food and drugs act for the condemnation and forfeiture of such salmon. As a result of the department's efforts large quantities of adulterated salmon were confiscated by the United States at widely separated points in the United States.

The department's litigation with the wool dealers who refused to comply with the requirements of the wool regulations of the War Industries Board applicable to the wool clip of 1918 was pressed very industriously and successfully during the year. One of the assistants in this office attended the trials and either handled them himself or assisted the United States attorneys in doing so. A more detailed report of this litigation will be found elsewhere herein.

By a decision of the Supreme Court on June 2, 1924, the department's ruling on the labeling under the food and drugs act of vinegar made from evaporated apples was sustained. It will be remembered that this is the issue which was decided favorably to the ruling by the District Court for the Northern District of Ohio, but which was reversed by two of the three judges of the circuit court of appeals for that circuit. This decision is discussed in more detail in a subsequent part of this report, but it may be stated here that while it settled the highly important issue in this particular case, it is of even more importance and significance in the enforcement of the food and drugs act with respect to prepared foods in general.

The following is a summary of the work of the office during the year, so far as it is practicable to present it statistically:

Five hundred and sixty-eight formal written opinions were rendered to the administrative officials of the department. No record was preserved of the advice given these officials in daily informal consultations, nor opinions expressed in brief pencil notations on papers sent to the office for consideration.

Seven hundred and seventy-five notices of judgment were prepared for publication pursuant to authority con-

tained in section 4 of the food and drugs act and section 4 of the insecticide act.

In addition to the criminal prosecutions hereinafter tabulated, 777 decrees of condemnation and forfeiture were entered under the food and drugs act and 2 under the insecticide act.

There were reported to the Department of Justice 3,092 violations of statutes intrusted to the department for enforcement. The following table shows the several statutes under which these violations were reported and the amounts of fines and recoveries in cases settled with and without contests:

*Cases reported, fines imposed, and judgments recovered*

Law involved	Number of cases	Fines and recoveries
National forest laws.....	281	\$54,633.06
Food and drugs act.....	1,141	13,593.00
28-hour law.....	680	57,475.00
Meat-inspection act.....	36	1,880.00
Animal quarantine acts.....	91	9,850.92
Lacey Act.....	-----	5.00
Migratory bird treaty act.....	739	12,629.25
Game law violation in national forests.....	-----	1,034.29
Pisgah game preserve.....	3	125.00
Insecticide act.....	67	2,204.00
Plant quarantine act.....	27	1,365.00
Section 84, penal code.....	16	20.00
Virus-serum-toxin act.....	2	-----
Miscellaneous.....	9	673.07
Total.....	3,092	155,537.59

*Contracts and leases prepared or examined*

Bureau, division, or office	Contracts	Leases	Total
Forest Service.....	1,329	3	1,332
Bureau of Animal Industry.....	5	21	26
Biological Survey.....	-----	7	7
Bureau of Chemistry.....	1	5	6
Chief clerk.....	1	2	3
Bureau of Entomology.....	3	28	31
Bureau of Agricultural Economics.....	8	83	91
Federal Horticultural Board.....	1	5	6
Insecticide and Fungicide Board.....	3	-----	3
Packers and Stockyards Administration.....	-----	9	9
Bureau of Plant Industry.....	11	29	40
Bureau of Public Roads.....	4	17	21
Office of Publications.....	1	-----	1
Weather Bureau.....	4	36	40
Grain Futures Trading Administration.....	-----	4	4
Solicitor's office.....	-----	4	4
Division of Accounts and Disbursements.....	2	-----	2
Fixed Nitrogen Research Laboratory.....	-----	1	1
Total.....	1,373	254	1,627

During the year 51 bonds, 339 renewals, and 40 terminations of leases and contracts were prepared. In addition to the examination for sufficiency of execution of the contracts and leases shown in the above tabulation, there were also examined 1,247 Federal highway project contracts, 550 modifications of such contracts, and 750 Federal warehouse bonds.

Twenty-eight claims of balances due estates of deceased employees were examined and the necessary papers prepared for their payment, and advice furnished administrative officers relative thereto.

Assistance was given the Interdepartmental Board of Contracts and Adjustments in the preparation of standard forms of building and supply contracts for the use of the several departments and independent establishments of the Government.

In the matter of the collection of loans made by the department under the seed-loan acts of 1921 and 1922, several cases were prepared and reported to the Department of Justice for institution of suits for securing recoveries of amounts due on such unpaid loans. Lien forms were also prepared, and advice given, in connection with the making of seed loans by this department in New Mexico under the joint resolution of April 26, 1924 (Public Res. No. 13, 68th Cong.).

Aid was given the advisory committee on finance and business methods in drafting orders and memoranda of the Secretary for the general administration of the department and to the Office of Inspection in the consideration of a number of claims for reimbursement for property lost or destroyed while being used for official work in the national forests.

Several of the department employees were arrested during the year for alleged violations of the District of Columbia traffic regulations and were represented at the trials and hearings by members of this office.

Five claims involving damages to privately owned personal property resulting from alleged negligence of department employees were considered under the act of December 28, 1922.

Claims of the department in a number of cases were prepared and filed in bankruptcy proceedings in various United States district courts.

Nine miscellaneous cases were reported to the Department of Justice for action involving assaults on department inspectors, and claims for the recovery of and for damages to Government property.

Many hearings and conferences touching the various activities of the department were attended by members of this office. Among these were hearings accorded the rosin and turpentine industry on regulations proposed to be promulgated under the naval-stores act, conferences of plant-quarantine officials from a large number of States held for the purpose of considering the administration of and the relations between State and Federal plant-quarantine laws, and conferences with the administrative officials of the Bureau of Agricultural Economics and representatives of the Liverpool Cotton Exchange relative to the application of the official cotton standards of the United States and the rules and regulations to be promulgated for enforcing them. Conferences were also attended on matters touching the administration of the grain-standards act, the promulgation of regulations under the tea and seed importation acts, regulations under the animal-quarantine laws, the Alaska game and fur laws, the migratory-bird treaty and the game-reservation and plant-quarantine acts. Practically daily conferences were had with attorneys and others interested on seizure and criminal cases arising under the food and drugs act, and numerous conferences were likewise held with lawyers and others touching litigation and other matters connected with the administration of the various other regulatory laws of the department.

Many regulations, orders, proclamations, forms, specifications, and schedules required in the administration of the various statutes committed to the department for enforcement were prepared or assistance given in their preparation, among the more important of which may be mentioned regulations to carry into effect the naval-stores, tea and seed importation acts, the food-products law, Alaska game and fur laws, and the game-reservation acts; regulations to prevent the spread of foot-and-mouth disease in cattle, sheep, and other ruminants and swine and amendments thereto; regulations governing the recognition of breeds and purebred animals, the sanitary handling and control of hides, glue stock, sheepskins, goatskins, and other animal by-products offered for entry into the United States; amendments to the migratory-bird treaty act regulations and those promulgated under the cotton futures and United States warehouse acts; amendments to the regulations governing neat inspection, importation of neat cattle, interstate movement of livestock and animal



tuberculosis eradication, and numerous amendments to the fiscal and administrative regulations. Orders for the establishment of animal and plant quarantines and for the revocation and suspension of grain inspectors were examined.

Proposed amendments to the food and drugs, meat-inspection, and plant-quarantine acts and proposed bills to regulate the sale and shipment of fertilizer in interstate and foreign commerce, to authorize the Secretary of Agriculture to issue licenses for the preparation for sale and transportation in interstate and foreign commerce of viruses, serums, toxins, and analogous products for use in the treatment of domestic animals, and to establish uniform weights for loaves of bread in interstate commerce were prepared. Proposed amendments to the packers and stockyards act were reviewed and suggestions made with respect to their legal sufficiency. Assistance was also rendered in the preparation of the department's reports upon various bills referred to it by committees of Congress having them in charge. Among the bills reported upon were the so-called McNary-Haugen bill (H. R. 9033), declaring an emergency in respect to certain agricultural commodities, to promote equality between agricultural commodities and other commodities, and for other purposes; one to empower certain officers, agents, and employees of this department to administer and take oaths, affirmations, and affidavits (H. R. 5937), one dealing with irrigation development (H. R. 8836); another to safeguard the distribution and sale of certain dangerous caustic or corrosive acids, alkalis, and other substances in interstate and foreign commerce (H. R. 8917); and another to prevent the shipment and sale in interstate commerce of nursery stock not true to name (H. R. 760).

Numerous papers of various kinds, including statements of issues, briefs, and memoranda on legal matters, were prepared at the request of officials of this department for submission to the Attorney General, the Secretary of the Interior, the Comptroller General, and officials of other departments. Also, many service and regulatory announcements, circulars, and bulletins, referred to this office for consideration from a legal aspect, were reviewed and comment made thereon.

Briefs and memoranda on legal questions were furnished in many of the cases reported to the Department of Justice for prosecution and assistance was given in the trials of some of the

cases. Among the more important cases in which this office assisted either in the preparation of the briefs or in the trials, or both, were *United States v. Charles J. Webb & Co.*, *United States v. Henry Marcus & Son*, *United States v. S. E. Avery*, *United States v. Wm. Rea, jr.*, *United States v. Kraus & Apfelbaum*, *United States v. Traugott, Schmidt & Sons*, and *United States v. Frederick G. Ringle*, all involving suits for the recovery of profits made by licensed wool dealers in excess of the rate of profits fixed by the War Industries Board; *United States v. Terminal Railroad Association of St. Louis*, a case arising under the 28-hour law; *United States v. 95 barrels, more or less, alleged apple cider vinegar* (265 U. S. 438); *United States v. Chichester Pills* (298 Fed. 829); *United States v. 22 bottles crab orchard concentrated mineral water*; *United States v. 154 sacks of oats* (294 Fed. 340); *United States v. 1,000 cases of sardines*; *United States v. 711 cases of frozen eggs*; *United States v. 99 cases tuna fish*; *United States v. 1,000 cases salmon*; *United States v. Hunt Manufacturing Co.*; and *United States v. Chemical Toilet Corporation*, all involving violations of the food and drugs act; and *Taggart v. Shilstone v. Bardone*, a case pending before the Court of Appeals of the District of Columbia, involving a patent interference.

Forms of indictments and informations were prepared by this office in practically all of the criminal violations referred to the United States attorneys for prosecution under the regulatory laws of the department. Forms of complaints in 28-hour law violations were also prepared and transmitted to the United States attorneys on which to base suits against carriers for recovery of penalties prescribed by that law. When practicable, labels were likewise prepared in seizure proceedings under section 10 of the food and drugs act and forwarded to the United States attorneys. Preparation of these pleadings materially aided the United States attorneys in handling the cases and greatly expedited their consideration by the courts.

#### THE NATIONAL FORESTS

There were handled during the year 328 claims for lands within the national forests, based upon the various land laws of the United States. Representatives of this office attended hearings before the United States local land officers in 40 cases, while oral arguments were made before the Secretary



of the Interior in three cases. Of 76 decisions rendered by the Interior Department closing cases, 47 decisions were favorable to the Government and 29 were unfavorable.

Thirteen hundred and fifty-nine legal papers of various kinds were prepared or passed upon and numerous written opinions were submitted. The attorneys of this office participated in 52 court cases.

Work for the Forest Service during the fiscal year, other than under the Weeks forestry law, included handling the following cases and other business:

Claims to lands.....	328
Hearings attended.....	40
Briefs prepared and filed.....	25
General litigation and settlements.....	44
Contracts, leases, etc.....	1,154
Bills, complaints, informations, protests, etc.....	205
Court appearances.....	52
Written opinions.....	452
Oral arguments before the Secretary of the Interior.....	3
Trespasses:	
Grazing.....	359
Timber.....	49
Fire.....	110
Occupancy.....	22
Property.....	12

*Trespass cases on the national forests in which damages and fines were recovered*

Character of trespass	Number	Damages	Fines
Grazing.....	190	\$32,622.43	\$1,670.00
Timber.....	24	7,544.70	50.00
Fire.....	61	11,471.60	892.90
Property.....	4	25.00	55.43
Occupancy.....	2		300.00
Total.....	281	51,663.73	2,969.33

**COURT DECISIONS OF INTEREST**

The case of *United States v. Henry Bowinkleman*, decided by the United States District Court for the Western District of Washington, is of unusual interest, as it involved conflicting claims to national forest land by a special-use permittee and a mining claimant. The permittee was occupying a special-use area as grazing headquarters and had improved it with a cabin and outbuildings. Thereafter, Bowinkleman located several mining claims, two of which conflicted with a portion of the inclosure covered by the special-use permit, ordered the permittee to discontinue occupancy of the area, and took possession of the buildings thereon. The matter was taken into the United States district court and an injunction secured restraining Bowinkleman from interfering with the occupancy of the special-use area by

the permittee. Upon his failure to comply with the terms of the injunction, Bowinkleman was arrested and, after hearing, sentenced to nine months in the county jail of Yakima County.

In *United States v. Joe Barrett*, tried in the Federal court for the Northern District of California, the defendant pleaded guilty and was sentenced to pay a fine of \$600, with the alternative of four months in the county jail, for leaving without extinguishing it a fire which he had set in a stump on his unpatented mining claim to burn out a rattlesnake. At the start of the trial, on a plea of not guilty, the defendant raised the objection that the lands within the mining claim were not public lands or public domain, within the meaning of sections 52 and 53 of the Penal Code of the United States, upon which the indictment was based. The Government contended that the land was public domain, and the court inclined to this view.

In *Chesapeake Western Railway et al. v. Henry C. Wallace*, Secretary of Agriculture, suit for an injunction was filed in the Supreme Court of the District of Columbia to restrain the Secretary from entering into a cooperative agreement with the city of Staunton, Va., respecting the administration of certain land on the watershed of North River, within the Shenandoah National Forest, on the ground that the diversion of water from this stream, as proposed by the city, would injure the riparian rights of the plaintiffs, who owned lands farther down the stream. The court dismissed the suit upon the grounds that the mere signing of the agreement could not injure the plaintiffs and that if the city diverted water to their injury the matter could then be taken into the proper court in the State of Virginia, which would be familiar with the local laws and competent to settle the controversy.

Some of the national forests embrace school lands granted by Congress to the several States. It has been the custom of the States to reconvey or relinquish these lands, both surveyed and unsurveyed, to the United States in exchange for other lands outside the national forests. In the recent case of *Newton v. State Board of Land Commissioners* (219 Pac. 1053), the Supreme Court of Idaho held that the Idaho State Board of Land Commissioners has no authority to reconvey the surveyed lands within the national forests. The provisions of the enabling act, that "all lands herein granted for educational purposes shall be disposed of only at public sale," and in the State

constitution, that "no school lands shall be sold for less than \$10 per acre," the court holds are mandatory and prohibit the disposal of the lands in any other manner.

In *Bowman v. McGoldrick Lumber Co.* (219 Pac. 1063), the Supreme Court of Idaho held that the act of March 2, 1889 (30 Stat. 990), granting rights of way through Indian reservations for railroads, conveys a base or qualified fee. This is in accord with the decision of the Supreme Court of the United States in *Rio Grande & Western Railway Co. v. Stringham* (239 Pac. 44), holding that under the general right-of-way act of March 3, 1875 (18 Stat. 482), the railroad gets a limited fee on an implied condition of reverter in the event the company ceases to use or retain the land for the purpose for which granted.

In *United States v. Bighorn Land & Cattle Co.*, unreported, a suit for the cancellation and forfeiture of a grant of a right of way for an irrigation reservoir under the irrigation right-of-way act of March 3, 1891 (26 Stat. 1095), on account of the failure of the grantee to construct a dam of the height specified in the grant, the United States District Court for Colorado decreed the cancellation and forfeiture of the grant to the extent that the dam was not constructed, leaving it intact for the constructed portion.

#### WEEKS FORESTRY LAW (36 Stat. 961)

Much progress has been made in the examination of titles to lands approved by the National Forest Reservation Commission for acquisition under the provisions of the Weeks forestry law. During the fiscal year, 223,397 acres have been acquired by the Government. Titles to this acreage and approximately 100,000 acres additional have been examined. These lands are in process of acquisition, either by condemnation proceedings or by direct purchases.

Agreements of purchase with 168 vendors, covering approximately 141,000 acres, were prepared and executed. The National Forest Reservation Commission at its meeting of December 15, 1923, authorized the purchase of 130,290 acres in the States of Alabama, Arkansas, Georgia, North Carolina, New Hampshire, Pennsylvania,

South Carolina, Tennessee, Virginia, and West Virginia.

The following is a summary, in terms of acres, of the operations, under the Weeks forestry law, during the fiscal year:

State	Acreage acquired, 1924	Acreage in condemnation	Title examined, acquisition pending	Acreage to be acquired
Alabama-----	3,437	1,026	1,558	1,853
Arkansas-----	3,910	1,242	1,242	1,863
Georgia-----	4,877	0	296	393
Maine-----	0	0	0	0
New Hampshire..	1,777	1,045	1,167	2,074
North Carolina..	1,831	3,075	3,971	3,971
Pennsylvania....	70,167	5,326	31,720	87,121
South Carolina..	964	0	556	796
Tennessee-----	9,047	8	17,795	18,621
Virginia-----	61,215	3,336	24,746	77,669
West Virginia...	66,172	298	10,177	14,009
Total-----	223,397	15,356	93,228	208,370

#### THE FOOD AND DRUGS ACT (34 Stat. 768)

One thousand one hundred and thirty-four cases were transmitted to the Department of Justice during the fiscal year, 264 for criminal prosecutions and 870 for seizures. The 264 criminal cases embraced 566 alleged violations of the food and drugs act.

One thousand four hundred and sixty-three civil cases were pending during the year. Included in this number were 593 cases that were pending at the close of the last fiscal year. Eight hundred and fifty-nine of these cases were terminated.

Of the 232 criminal cases that were pending at the close of the fiscal year 1923 and the 264 cases that were reported during the present fiscal year, 200 were terminated.

The total number of cases terminated during the year, both civil and criminal, was 1,059.

In 183 of the 200 criminal cases terminated fines were imposed or collateral forfeited. Pleas of guilty, nolo contendere, etc., were entered in 175 cases. In 5 fines were imposed after trial and conviction, and in 1 collateral that had been deposited by the defendant was forfeited by reason of his non-appearance in court. In 2 cases defendants were acquitted, and 18 cases were nolle prossed or the information dismissed.



*Fines imposed in criminal cases (exclusive of costs which were generally assessed)*

Number of cases	Amount of fine	Total	Number of cases	Amount of fine	Total
1	\$500	\$500	46	\$50	\$2,300
1	450	450	2	45	90
3	300	900	2	40	80
1	250	250	1	35	35
1	225	225	2	30	60
8	200	1,600	36	25	900
1	180	180	5	20	100
12	150	1,800	3	15	45
1	125	125	11	10	110
1	120	120	3	5	15
34	100	3,400	3	1	3
1	80	80			
4	75	300	183		13,660

Of the 859 civil cases terminated during the fiscal year, default decrees of condemnation, forfeiture, and destruction of the product seized were entered in 370; in 1 there was confession of judgment and entry of decree for condemnation and forfeiture with provision under bond to separate the good from the bad in the product seized; in 6, decrees of condemnation and forfeiture, with privilege of sale of the product in compliance with the terms of the act, were entered; in 367, consent decrees of condemnation and forfeiture were entered and the product released under bond; in 13, decrees pro confesso were entered; 1 case was tried on stipulation of facts resulting in judgment for the Government and the release of the goods under bond; 14 were contested, all of which resulted in verdicts for the Government after trial; and in 87, the libels were either dismissed or the product disposed of before actual seizure could be consummated. In 4 cases the goods were returned to the shipper or claimants who gave bond to recondition or relabel or both recondition and relabel the goods, as the case might be, in compliance with the food and drugs act; in 1 case, by consent, a decree of condemnation, forfeiture, and destruction of the article seized was entered; and in 11 cases, decrees of condemnation, forfeiture, and destruction were entered with provision, however, that the claimants, under bond, might have the goods to be sold in a manner and for purposes not in conflict with the law.

At the close of the year 900 cases were pending, of which 296 were criminal prosecutions and 604 were seizures.

In addition to the cases reported by this department to the Department of

Justice, the food and drug officials of the various States and the District of Columbia, collaborating with the department in the enforcement of the act, reported seven cases to the United States attorneys, all of which were terminated during the year. Of these six were seizures and one a criminal case. In the criminal case terminated \$25 collateral deposited by the defendant was forfeited on account of his nonappearance in court. In one of the seizure cases the goods were released under bond after the entry of a consent decree of condemnation and forfeiture, and in the other five default decrees of condemnation, forfeiture and destruction were entered of record against the goods seized.

Seven hundred notices of judgment were prepared and published during the year.

#### COURT DECISIONS OF INTEREST

In the case of *United States v. 95 barrels, more or less, alleged apple cider vinegar, Douglas Packing Co., claimant*, the Supreme Court, on June 2, 1924, held that vinegar made from dried or evaporated apples and labeled "Apple cider vinegar" was misbranded, notwithstanding its close resemblance in composition to genuine apple cider vinegar. This ruling of the Supreme Court sustains the administrative decision of this department defining apple cider vinegar to be the product made by the alcoholic and subsequent acetous fermentations of the juice of apples, and finally determines a controversy of long standing in the vinegar trade. The opinion, in effect, holds that an article must be the identical thing represented by its label, irrespective of its merits, and may not be deceptively represented to purchasers. Moreover, the court in this case holds that deception may result from the use of statements not technically false or which may be literally true; that the aim of the statute is to prevent deception resulting from indirection and ambiguity as well as from statements which are false, and that where statements are ambiguous and liable to mislead, they will be read favorably to the accomplishment of the purpose of the act.

This case is the culmination of proceedings begun in the United States district court at Cleveland, Ohio, for the seizure and confiscation of the vinegar in question. The district court ruled in favor of the Government. Claimant appealed to the Circuit Court of Appeals for the Sixth Circuit, which reversed the judgment of the district



court. Thereupon the Government sought and obtained a favorable review of the case by the Supreme Court.

The case of *United States v. Chiesher Chemical Co., Food and Drugs Nos. 13407-8*, a seizure proceeding based on a libel alleging misbranding of certain pills in that the therapeutic claims on the label were false and fraudulent, was reviewed by the Court of Appeals of the District of Columbia. In the trial of the case before the lower court the Government offered evidence to show what the consensus of medical opinion was as to the therapeutic value of the pills in question. This was objected to by the claimant's counsel and the objection was sustained by the court. The Government excepted. After the submission of the case to the jury a verdict was returned adverse to the Government. The court of appeals, in reversing the judgment of the lower court, held that the expert testimony offered by the Government should have been admitted to show what the consensus of medical opinion was with respect to the curative properties of the various ingredients of the article sought to be condemned.

The case of *United States v. 1,000 cases of canned salmon, Food and Drugs No. 16248*, was a seizure proceeding in which the libel charged adulteration of the article seized in that it was composed wholly or in part of a filthy, decomposed, or putrid animal substance. After the trial of the case in the United States district court of Chicago, the court directed a verdict for the claimant on the ground that the evidence of the claimant overbalanced the evidence of the Government. Exception to this instruction was noted by the Government and an appeal taken. Upon review by the Circuit Court of Appeals for the Seventh Circuit the appellate court agreed with the contention of the Government that the evidence in the case should have been submitted to the jury for its consideration. The ruling of the lower court was accordingly reversed and the case remanded for new trial.

The cases of *United States v. Canned Salmon, Food and Drugs Nos. 14262 and 14945* (the former remanded by the Circuit Court of Appeals for the Ninth Circuit for retrial), were seizure proceedings tried before juries on libels alleging that the product was composed of filthy, decomposed, or putrid animal substance. The court in each instance charged the jury that the word "article" as used in the statutes referred to the entire shipment and that a verdict for the Gov-

ernment should be returned if the product was found to be so filthy, decomposed, or putrid as to be unfit for food. A verdict was returned for the Government in each instance.

The case of *United States v. 500 cases Hobbie brand pink salmon, Food and Drugs No. 17290*, was a seizure proceeding against canned salmon, the libel alleging that the article was composed in whole or in part of a filthy, decomposed, or putrid animal substance. The case was tried before a jury and the court in commenting upon the meaning of the word "article" as used in the act instructed the jury in the language of the Circuit Court of Appeals for the Ninth Circuit (*A. O. Anderson & Co. v. U. S. 284 Fed. Rep. 542*), as follows:

"The meaning of the word 'article' must therefore be gathered from a consideration of the entire act, and we may add in this connection that the rule of strict construction invoked by the defendant in error has little or no application to statutes designed to promote the public health or public safety. Section 1 of the act prohibits the manufacture within any Territory or the District of Columbia of any article of food or drugs, adulterated or misbranded within the meaning of the act; section 2 prohibits the introduction of any such article into any State or Territory or into the District of Columbia from any other State or Territory or the District of Columbia, or from any foreign country; section 6 defines adulteration, and section 10 prescribes the procedure for the condemnation. In all of these sections we are convinced that the word 'article' is used in its broad and comprehensive sense and has reference to the food product, not to the smallest individual container. Any other construction would defeat the entire purpose of the law."

The court also instructed the jury that the act allowed no tolerance, and that if they found a substantial percentage of decomposition which extended throughout the entire parcel they could find for the Government. The jury returned a verdict for the Government.

The case of *United States v. 496 cases, etc., "Klawack Brand" canned salmon, Food and Drugs Nos. 17383, 17385, etc.*, was a seizure proceeding based on a libel which alleged that the product was composed in whole or in part of a filthy, decomposed, or putrid animal substance. The court instructed the jury that they might take into consideration whether the product contained decomposed animal sub-

stance to such an extent as to be in excess of the amount which might creep into a shipment when the canner used reasonable care and caution in the operation of his plant, and by way of comment on the evidence suggested that the tolerance might be about one-half of 1 per cent. The evidence on both sides indicated far more than this amount and the jury returned a verdict for the Government. A decree of condemnation and destruction was subsequently entered.

The case of *United States v. 100 cases of sardines, etc., Food and Drugs Nos. 17958-9*, was a seizure proceeding, the libel alleging that the article was adulterated in that it was composed in whole or in part of filthy, decomposed, or putrid animal substance. The court instructed the jury that while there was no burden on the Government to prove that the article might be injurious to health, yet the evidence must satisfy them that the product was so decomposed or putrid as to be unfit for food. The jury returned a verdict for the Government and a decree was entered ordering the goods to be destroyed.

#### THE INSECTICIDE ACT OF 1910 (36 Stat. 331)

Sixty-seven cases were reported to the Attorney General during the fiscal year ended June 30, 1924, in 61 of which, involving 77 violations, criminal proceedings were recommended, and in 6 of which seizures were recommended. At the close of the fiscal year ending June 30, 1923, 85 cases were pending, 82 of which were criminal prosecutions and 3 civil, or seizure, cases.

Forty cases pending at the close of the preceding fiscal year and 25 cases reported during this year, in all 65 cases, were terminated during the year. Of the cases terminated, 63 were criminal and 2 were civil cases. Of the 63 criminal cases, 1 was dropped because of the statute of limitations, fines were imposed in 45, and 16 were dropped or dismissed. Pleas of guilty were entered in 40 cases, pleas of nolo contendere in 5, and a verdict of not guilty in 1.

In the criminal cases in which convictions resulted the fines were as follows:

Number of cases	Amount of fine	Total	Number of cases	Amount of fine	Total
4	\$1	\$4	2	\$75	\$150
3	10	30	7	100	700
1	20	20	1	150	150
21	25	525	1	200	200
4	50	200	1	225	225
Total.....			45		2,204

Court costs were assessed in the greater number of cases in which convictions resulted. Decrees of condemnation and forfeiture were entered in two civil or seizure cases, in one of which the goods were released under bond, and in one of which the goods were destroyed. Seventy-five notices of judgment were prepared and published.

#### MEAT-INSPECTION ACT (34 Stat. 1260)

Thirty-six cases were reported to the Attorney General for prosecution under this act. Of these, 14 were terminated by fines, as follows: 1, \$500; 2, \$100 each; 1, \$75; 6, \$50 each; 1, \$30; 2 \$25 each; and 1, \$20. Two cases were terminated without prosecution—one by dismissal, and the other by refusal of the grand jury to indict.

Of the cases pending at the close of the preceding fiscal year, 11 were terminated by fines, as follows: 3, \$150 each; 3, \$50 each; 3, \$25 each; 1, \$20; and 1, \$10. Five cases were dismissed, 1 was nolle prossed, 4 were terminated by refusal of the grand jury to indict, and the prosecution of 6 was barred by the statute of limitations.

Fines aggregating \$1,880 were imposed in the 25 cases, as follows:

#### *Fines imposed in meat-inspection cases.*

Number of cases	Fines	Total	Number of cases	Fines	Total
1	\$500	\$500	1	\$30	\$30
3	150	450	5	25	125
2	100	200	2	20	40
1	75	75	1	10	10
9	50	450			
Total.....			25		1,880

**TWENTY-EGHT-HOUR LAW (34 Stat. 607)**

Six hundred and eighty cases were reported to the Attorney General during the fiscal year.

Penalties aggregating \$57,475 were recovered in 564 cases. One hundred and seventy-two cases were dismissed and 10 were determined adversely to the Government.

Nine hundred and thirty cases were pending at the close of the fiscal year.

*Penalties assessed under the 28-hour law*

Number of cases	Penalty	Total	Number of cases	Penalty	Total
546	\$100	\$54,600	4	\$200	\$800
5	110	550	4	250	1,000
1	125	125	12	100	100
2	150	300			
Total			564		57,475

<sup>1</sup> Lump penalty.

**ACTS RELATING TO THE INTERSTATE MOVEMENT OF LIVESTOCK FROM QUARANTINED DISTRICTS, PROHIBITING THE INTERSTATE MOVEMENT OF DISEASED LIVESTOCK, AND PROHIBITING THE IMPORTATION OF DISEASED LIVESTOCK (23 Stat. 31; 26 Stat. 414; 32 Stat. 791; 33 Stat. 1264)**

No cases involving violations of the act of May 29, 1884 (23 Stat. 31) were reported to the Attorney General for prosecution. Of the cases pending at the close of the fiscal year ending June 30, 1923, 1 was terminated by a fine of \$200 and costs; 2 by a fine of \$100 each; and 1 by a fine of \$10; 2 cases were dismissed, 1 was nolle prossed, and 1 was barred by the statute of limitations.

Fifty-nine cases were reported to the Attorney General for prosecution under the act of February 2, 1903 (32 Stat. 791), of which 1 was terminated by a fine of \$300, 1 by a fine of \$200, 2 by a fine of \$200 and costs each, 7 by a fine of \$100 each, 4 by a fine of \$100 and costs each, and 2 by a fine of \$25. Five cases were dismissed and in 1 case a sentence of 1 day in jail was imposed. Of the cases pending at the close of the preceding fiscal year, 1 was terminated by a fine of \$300 and costs, 1 by a fine of \$200, 2 by a fine of \$200 and costs each, 1 by a fine of

\$150, 7 by a fine of \$100 each, 11 by a fine of \$100 and costs each, 1 by a fine of \$25 and costs, 1 by a fine of \$10 and costs, and 1 by a fine of \$5. Two cases were nolle prossed, 1 was barred by the statute of limitations, and 2 were dismissed.

Thirty-two cases were reported to the Attorney General charging violations of the act of March 3, 1905 (33 Stat. 1264), of which 2 were terminated by a fine of \$200 each, 2 by a fine of \$200 and costs each, 2 by a fine of \$100 each, and 1 each by fines of \$150, \$100 and costs, and \$10. Of the cases pending at the close of the preceding fiscal year, 3 were terminated by a fine of \$500 and costs each, 1 by a fine and costs of \$275.92, 1 by a fine of \$200 and costs, 5 by a fine of \$100 each, 7 by a fine of \$100 and costs each, 1 by a fine of \$25, 3 by a fine of \$10 each, and 2 by a fine of \$5 each. Five cases were nolle prossed, 4 were dismissed, and 2 were barred by the statute of limitations. Report of "no true bill" was returned by a grand jury in 1 case and in 2 others the defendants were acquitted. In 1 case the court remitted \$90 of the \$100 fine imposed.

In all, 91 cases under the animal quarantine laws were reported to the Attorney General.

Cases disposed of by the imposition of fines are as follows:

Number of cases	Fines	Total	Number of cases	Fines	Total
3	\$5.00	\$15.00	12	\$200.00	\$2,400.00
6	10.00	60.00	1	275.92	275.92
4	25.00	100.00	2	300.00	600.00
46	100.00	4,600.00	3	500.00	1,500.00
2	150.00	300.00			
Total			79		9,850.92

In each of the cases reported to the Attorney General for prosecution under the acts of February 2, 1903, and March 3, 1905, a suggested form of indictment or criminal information was prepared and submitted therewith for use by the United States attorneys.

**VIRUS-SERUM-TOXIN ACT (37 Stat. 833)**

Two cases were reported under this act during the year, but were still pending at its close.



## THE MIGRATORY-BIRD TREATY ACT (40 Stat. 755)

Seven hundred and thirty-nine cases were reported to the Attorney General. Fines were imposed under the migratory-bird treaty act as follows:

Num- ber of cases	Amount of fines	Total	Num- ber of cases	Amount of fines	Total
2	( <sup>1</sup> )	-----	4	\$30. 00	\$120. 00
1	\$0. 25	\$0. 25	3	40. 00	120. 00
33	1. 00	33. 00	1	45. 00	45. 00
1	2. 00	2. 00	40	50. 00	2, 000. 00
10	2. 50	25. 00	2	65. 00	130. 00
133	5. 00	665. 00	1	75. 00	75. 00
11	7. 50	82. 50	9	100. 00	900. 00
191	10. 00	1, 910. 00	1	125. 00	125. 00
1	12. 00	12. 00	1	150. 00	150. 00
36	15. 00	540. 00	1	200. 00	200. 00
5	16. 40	82. 00	2	250. 00	500. 00
1	17. 50	17. 50	2	300. 00	600. 00
26	20. 00	520. 00	1	475. 00	475. 00
132	25. 00	3, 300. 00			
Total	-----		651	-----	12, 629. 25

<sup>1</sup> Costs.

One hundred and forty-six cases were either nolle prossed or dismissed. Verdicts of not guilty were returned by juries in 53 cases and a demurrer sustained in 1. Order for the forfeiture of 31 strands of aigrettes was entered in 1 case and in another a sentence of 1 day in jail was imposed.

## THE LACEY ACT (35 Stat. 1137)

No cases were reported to the Department of Justice. Of the cases pending at the close of the preceding fiscal year, a fine of \$5 was imposed in one and two were dismissed. In another a demurrer to the information was sustained by the court.

## PISGAH GAME-PRESERVE LAW (39 Stat. 476)

Three cases were reported to the Department of Justice. Two were pending at the close of the last fiscal year.

### *Fines imposed under the Pisgah game preserve law*

Number of cases and fines:	Costs.
1-----	\$25
1-----	100
Total-----	125

One case was nolle prossed and a verdict of not guilty returned in another.

## BIRD AND ANIMAL RESERVATION TRESPASS CASES. (Sec. 84, Penal Code)

Sixteen cases were reported to the Department of Justice, of which two were closed by the imposition of a fine of \$10 each.

## NATIONAL-FOREST GAME REGULATION (Reg. T-1)

A number of cases involving hunting and fishing on national forests in violation of State laws were reported. Of these, 23 were closed by conviction and the imposition of fines and costs amounting in all to \$1,084.29.

## UNITED STATES GRAIN STANDARDS ACT (39 Stat. 482)

Consideration was given to the suspension and cancellation of a number of licenses issued under the act. Conferences were held with representatives of the Bureau of Agricultural Economics relative to the administration of the grain standards act.

## GRAIN FUTURES ACT (42 Stat. 998)

Miscellaneous inquiries with respect to the grain futures act from the administrative officers and outside persons were answered.

## COURT CASES OF INTEREST

In *State v. Rosenbaum Grain Co.* (222 Pac. 80), which was a suit to enjoin the grain company from maintaining and operating a commission house in Hutchinson, Kans., contrary to the bucket-shop law, and to enjoin the telegraph company from furnishing telegraphic facilities for such maintenance and operation, the Supreme Court of Kansas held that, in buying and selling grain for future delivery on a commission basis, the grain company was engaged in interstate commerce within the scope of the grain futures act and that until the company is deprived by competent authority of contract market privileges under that act it may not be enjoined from conducting its business, and that the telegraph company could not be enjoined from furnishing interstate telegraphic facilities necessary to conduct the grain company's business.

An order was issued by a supreme court justice of the State of New York restraining Harry C. Schauble, of New York City, from engaging in what were referred to by the State Attorney General as "fraudulent practices" in connection with selling and offering for sale "advance" and "decline" guaranties on cotton, cotton futures and options, and transactions in stock privileges known as "puts," "calls," and "spreads." The evidence in the case was clear that no actual transaction in stocks or commodities was intended and that all Schauble had to do was to set a definite closing figure, and if this figure was reached, a remittance of alleged profit would be made.

**UNITED STATES WAREHOUSE ACT, AS AMENDED (39 Stat. 486; 41 Stat. 266; 42 Stat. 1282)**

The work of this office during the year under the United States warehouse act increased considerably over previous years. Regulations for potato, peanut, and broomcorn warehouses were reviewed, these three commodities having been added to those for which licenses may be issued. Various forms were prepared for the use of the Bureau of Agricultural Economics and advice was given to those charged with the administration of the act. The questions submitted, often informal, were varied in nature and frequently involved an examination and understanding of State laws. There were reviewed for legal sufficiency 750 bonds submitted in connection with applications for licenses.

**PACKERS AND STOCKYARDS ACT (42 Stat. 159)**

Proposed amendments to the act were reviewed and suggestions with reference to their legal sufficiency were offered to the Packers and Stockyards Administration. Opinions were rendered on a number of legal questions arising in the administration of the act and advice was given with reference to the proper procedure to be followed and to legal requirements of complaints and orders to be issued in proceedings instituted under the act. The auditors' reports, the complaints and the orders in numerous individual cases were reviewed. Memoranda were prepared on several questions submitted to the Attorney General for opinion.

**FOOD PRODUCTS INSPECTION LAW (42 Stat. 1289, 1313)**

Assistance was given the Bureau of Agricultural Economics in the preparation of regulations and cooperative agreements for carrying on the purposes of the law. Various legal questions submitted by the administrative officers and a few by private citizens were answered. The extension of the shipping point inspection service through cooperative agreements with State and private inspection organizations has increased materially the administrative, and consequently the legal, work incident to accomplishing the objects of this law.

**COTTON FUTURES ACT (39 Stat. 476)**

At the request of a Senator, a bill for amendment of section 5 of the cotton

futures act was drafted in cooperation with the Bureau of Agricultural Economics. Amendments to the regulations were drafted in cooperation with the bureau and an opinion rendered with respect to the validity of a suggested change in the contract and rules of the New York Cotton Exchange.

On request of a Member of Congress, a general antibucketing bill was prepared in cooperation with the bureau.

**COURT DECISIONS OF INTEREST**

In *Moore v. New York Cotton Exchange* (296 Fed. 61), it was held by the United States Circuit Court of Appeals, affirming the district court, that the New York Cotton Exchange could not be compelled to furnish its quotations to the Odd Lots Cotton Exchange. The suit was filed by the Odd Lots Exchange alleging a violation of the Sherman Antitrust Act.

**FEDERAL WATER POWER ACT (41 Stat. 1063)**

Opinions prepared by the chief counsel of the Federal Power Commission and submitted to the Secretary of Agriculture for consideration were reviewed and commented on. A bill was prepared for the relief of the Pitt River Power Co. in the matter of a payment made by it in connection with an application for a water-power permit filed with this department prior to the enactment of the Federal water power act.

**UNITED STATES COTTON STANDARDS ACT (42 Stat. 1517)**

Several conferences were held with administrative officers of the Bureau of Agricultural Economics and representatives of the Liverpool Cotton Exchange with reference to the application of the official cotton standards of the United States and the rules and regulations to be promulgated for enforcing the act. Cooperative agreements for execution by the Secretary of Agriculture and the principal representatives of the foreign exchanges were approved. Various legal questions submitted by the bureau and outside parties were answered.

**CAPPER-VOLSTEAD COOPERATIVE MARKETING LAW (42 Stat. 388)**

Many legal questions submitted to the department by persons interested in the act, principally in its relations to the Federal antitrust laws, as well as by the Bureau of Agricultural Economics, were answered. Comment was made



for the benefit of the Assistant Secretary upon a proposed scheme of marketing and price-fixing for wheat.

### PLANT QUARANTINE ACT (37 Stat. 315)

During the preceding year 27 cases were reported to the Attorney General for prosecution under the plant quarantine act of August 20, 1912 (37 Stat. 315), as amended by the act of March 4, 1917 (39 Stat. 1165). Of these 9 were closed during the year by the imposition of fines. At the close of the preceding fiscal year there were 37 cases pending, 25 of which were closed during this year by the imposition of fines and 2 by the quashing of the informations. In addition, fines were imposed in 2 cases instituted by United States attorneys upon their own initiative.

#### *Fines imposed in plant-quarantine cases*

Number of cases	Amount of fine	Total	Number of cases	Amount of fine	Total
5	\$1	\$5	6	\$50	\$300
6	10	60	2	100	200
1	15	15	1	200	200
3	20	60	1	250	2.0
11	25	275			
Total.....			36		1,365

Twenty-eight cases are still pending, including 10 of those pending at the close of the preceding fiscal year and 18 submitted this year.

A representative of this office participated in an important conference held April 28 to 30, which was attended by the plant quarantine officials from a large number of States, for the purpose of considering the administration of, and the relation between, State and Federal plant-quarantine laws. A memorandum was prepared by this office for distribution at the conference, setting forth the scope and limitation of both Federal and State quarantine powers, as determined by decisions of the United States Supreme Court.

### FEDERAL HIGHWAY ACT (42 Stat. 212)

Project statements for 1,143 projects approved by the department were reviewed to determine whether they were eligible for Federal aid. These projects involved a total estimated expenditure of \$409,027,172.68 and 16,372.4706 miles of road. The amount of Federal aid which will be allocated for these projects has not yet been determined, as, under the revised proj-

ect statement form now being used, a project covers the whole route between given control points, and the Federal aid is only requested and allocated as each section of the project is reached for actual construction.

During the fiscal year project agreements and certificates of approval of plans, specifications, and estimates, prepared by the Bureau of Public Roads, for 1,428 projects were reviewed as to their form and sufficiency of their execution by the State highway departments and were submitted to the Secretary and executed by him, involving a total estimated expenditure of \$181,500,000, Federal aid aggregating \$81,779,128.70, and 8,287.2 miles of road. Drafts of 550 modifications of project agreements and certificates, prepared by the Bureau of Public Roads for execution by the State highway departments and the Secretary, were similarly reviewed.

There were also reviewed as to form, substance, and sufficiency of execution, 64 original agreements for the construction of roads within or partly within the national forests. There were similarly reviewed 40 cooperative agreements between the department and cooperating agencies within the several States for constructing 40 road projects within or partly within the national forests.

#### OPINIONS OF INTEREST

On April 3, 1924, the Comptroller General rendered an opinion upon that part of section 3 of the Federal highway act which authorizes cooperation with the State highway departments and with the Department of the Interior in the construction of highways within Indian reservations. He held that the term "within Indian reservations," as used in the act, does not embrace all land within the exterior boundaries of the reservations, but only land within the exterior boundaries over which the Secretary of the Interior has jurisdiction and control. The comptroller then applied this opinion to the specific case of a road proposed for construction lying within a railroad right of way wholly within an Indian reservation, the question being whether the proposed roadway was therefore "within an Indian reservation" so as to be financed wholly out of Federal-aid funds, and it was held that, inasmuch as the land embraced in the railroad right of way had been deeded by the Indians to the United States and by the United States to the railroad, it was no longer under the jurisdiction and control of



the Secretary of the Interior and therefore the Government's proportionate cost of a highway constructed over such area is for determination under the general provisions of the controlling statute and not under section 3, providing for special conditions.

#### SMITH-LEVER ACT FOR COOPERATIVE AGRICULTURE WORK (38 Stat. 372)

Two formal opinions were given to the officials in charge of the cooperative extension work of the department, and a representative from this office attended a conference with railroad executives for the purpose of discussing a proposed plan for cooperation between the department and the railroads in the extension of agricultural information.

#### CENTER MARKET ACT (41 Stat. 1441)

Advice was given the superintendent of Center Market on a number of questions which arose during the year in the administration of the act, and suggestions were made as to the provisions of leases, permits, and like papers required in administering the market.

#### COLLECTION AND DISTRIBUTION OF EXCESS PROFITS ON WOOL CLIP OF 1918

In the closing month of the last fiscal year, the legal aspect of the collection of excess wool profits had entered upon a new phase. In the beginning the wool dealers' opposition to the collection of excess profits manifested itself first in attacks upon the legal authority of the War Industries Board to regulate the handling of wool at all, and especially upon the particular method in which it was regulated. Many court decisions favorable to the Government had weakened considerably this line of resistance and made possible the bringing of several cases to trial upon the facts. One tried in the last days of June, 1923, was stubbornly contested, and many of the department's interpretations of the regulations were questioned. The new phase of the dealers' resistance has been and is, therefore, to seek to obtain court interpretations of the regulations which will render them ineffective. In this they are aided materially by the many ambiguities in the regulations, caused, no doubt, by the haste with which they were made under stress of a national emergency.

The department's interpretations have been reached after much study and thought and lean always to the side of equity and justice. So it is felt that in the end they will prevail. However, it is not to be denied that the looseness of expression in the regulations offers a fertile field for the dealers' opposition, tends to confuse the courts, and very materially contributes to the delay in completing this work. Illustrative of this is a case mentioned in the report of this office for the year 1923 as having been tried in the closing days of June. As yet the court has handed down no decision.

Also a case tried in another court in February last. There the question was as to the meaning of the phrase "gross profits" as used in the regulations, and the court gave to it an interpretation which, if finally upheld, would preclude the recovery by the Government from practically any wool dealer. Steps were taken in preparation for an appeal, one of which consisted of the filing of certain requests for rulings which were prepared in this office. Upon consideration of these requests the court receded from the position formerly taken and requested reargument. Because of the crowded condition of the docket it has not been possible to reach the case for reargument.

In a case argued on demurrer in another jurisdiction the interpretation of another very essential and ambiguous phrase in the regulations came into question. The hearing in this case was had in June, and no decision can be expected until fall.

Thus, the effort to sustain the validity of the regulations being practically won, their enforcement has been impeded by the imperfections with which they abound.

Yet another phase of the work was entered upon during the year by the pressing to trial and hearing of two so-called nonpermittee cases. These are cases in which the Government can not rely upon the dealer's written agreement to abide by the regulations, as in the cases heretofore decided, but must found its actions upon the validity of the regulations, as regulations, and upon implied contract. The first was *United States v. Henry Marcus & Son*, tried in the district of Maryland in February, and the other *United States v. Traugott Schmidt & Sons*, heard on demurrer in the eastern district of Michigan in June. No decision has been rendered in either.

During the year five cases were heard on demurrer. In each this office

made the oral argument and prepared the briefs. In three the decisions were favorable to the Government. Decisions have not been rendered in the other two.

Two cases were tried on the merits. In one judgment was rendered in favor of the Government. No judgment has been rendered in the other. One case was settled by agreement with defendants upon the eve of trial.

Eight cases were closed, six of these by collections either with or without judgment and the other two because of the hopeless insolvency of the defendants. In six other cases judgments were rendered without trial, but had not been collected at the close of the year.

Since the beginning of this work 69 cases have been submitted to this office for collection. Fifty-four of these have been reported to the Department of Justice, 10 are in process of being so reported, 2 have been settled without being submitted to the Attorney General, 2 are being held under consideration, and 1 pending removal of protest

upon payment made. Of the 54 cases reported to the Department of Justice, 20 have been settled and closed, judgments have been rendered but not executed in 8, and 2 stand tried but undecided.

As heretofore, the service of this office in the enforcement of the regulations has consisted of conducting from start to finish the legal fight to sustain their validity and the department's interpretations of them and to enforce the collection of excess profits, and of advising the Bureau of Agricultural Economics relative to interpretation of the regulations, action to be taken to enforce them, and other legal questions arising in their enforcement.

### PATENTS

Thirty-four applications for letters patent on inventions of employees of the department were prepared and filed. During the year 31 were allowed and 7 disallowed. The following table shows the status of applications on June 30, 1924:

*Patents applied for by members of the department*

Applicant	Bureau	Invention	Disposition of application
R. Thelen	Forest Service	Kiln	Allowed.
R. F. Gardner	Soils	Soil fertilizer	Disallowed.
J. S. Bright and L. I. Hewes	Public Roads	Pavements	Do.
G. F. Mitchell	Chemistry	Beverages	Pending.
A. C. Morgan, K. B. McKinney, and J. Milam	Entomology	Powder-dusting machine	Disallowed.
J. M. Sherman and R. H. Shaw	Animal Industry	Propionic acid	Allowed.
R. R. Henley	do	Clarified serum antitoxin	Do.
A. C. Weimar	do	Insecticide	Disallowed.
K. J. Matheson	do	Swiss cheese	Allowed.
F. C. Lincoln	Biological Survey	Bird trap	Pending.
H. S. Paine and J. Hamilton	Chemistry	Fondant	Do.
C. F. Walton and H. S. Paine	do	Maple sirup of high density	Allowed.
Do	do	Maple product	Do.
H. S. Paine and F. W. Reynolds	do	Desugarizing molasses	Disallowed.
T. H. Scheffer and L. K. Couch	Biological Survey	Beaver trap	Allowed.
J. W. Turrentine	Soils	Countercurrent lixiviator	Do.
H. C. Gore	Chemistry	Cane sirup	Do.
A. Hermann and C. A. Menzel	Forest Service	Hygrometer	Do.
E. C. Sherrard	do	Stock food	Do.
L. G. Carnick	Public Roads	Filler for cracks in concrete roads	Pending in interference.
M. E. Dunlap	Forest Service	Controlling humidity of work-rooms	Allowed.
F. E. Denny	Chemistry	Coloring lemons	Do.
L. A. Rogers	Animal Industry	Food product from skimmed milk	Do.
G. H. Mains	Chemistry	Varnish and paint remover	Do.
W. V. Cruess		Fruit confections	Pending.
R. Thelen and H. D. Tiemann	Forest Service	Kiln	Allowed.
H. C. Gore	Chemistry	Maltose	Pending.
B. Drummond	Plant Industry	Support for branches	Do.
H. C. Gore	Chemistry	Sweet-potato product	Do.
R. Thelen	Forest Service	Kiln	Allowed.
H. C. Gore	Chemistry	Diastatic material	Do.
Arno Viehoever and Ruth G. Capen	Chemistry	Cantharidin	Pending.
R. B. Leeper	Animal Industry	Hair remover	Allowed.
R. Thelen	Forest Service	Kiln	Pending.
C. A. Richards and E. Bateman	do	Pulp preservative	Do.
S. E. Piper and H. E. Williams	Biological Survey	Strychnine	Disallowed.
H. S. Paine, C. F. Walton, and V. Birckner	Chemistry	Cane sugar	Pending.

*Patents applied for by members of the department—Continued*

Applicant	Bureau	Invention	Disposition of application
A. T. Goldbeck	Public Roads	Weighing device	Allowed.
Do.	do.	Foundation for roads	Pending.
E. B. Smith	do.	Accelerometer	Do.
J. D. Rue, S. D. Wells, and F. G. Rawling	Forest Service	Pulp	Do.
J. S. Townsend	Plant Industry	Cotton gins	Allowed.
F. H. Jackson	Public Roads	Gravel tester	Do.
G. H. Mains and F. B. Stieg	Chemistry	Comminution of powder	Do.
H. Bryan, A. L. Mehring, and W. H. Ross	Soils	Electric furnaces	Pending.
R. Thelen	Forest Service	Kiln	Do.
Do.	do.	Wood seasoning	Do.
Do.	do.	do.	Do.
A. C. Lindauer and G. M. Hunt	do.	Glue	Allowed.
H. C. Gore	Chemistry	Maltose product	Disallowed
G. F. Taylor	Plant Industry	Thermometer	Allowed.
G. F. Taylor	do.	Thermostat	Do.
P. A. van der Meulen	Entomology	Spraying material	Pending.
E. C. E. Lord	Public Roads	Absorption of dye of soils	Allowed.
H. S. Paine	Chemistry	Confectionery	Pending.
S. E. Piper and H. E. Williams	Biological Survey	Strychnine	Do.
T. A. Carlson	Forest Service	Board tester	Do.
W. H. Ross, R. M. Jones, and A. L. Mehring	Soils	Potassium phosphate and phosphoric acid	Do.
Do.	do.	Phosphoric acid	Do.
M. S. Badollet, J. Hamilton, and C. F. Walton, jr.	Chemistry	Colorimetric standards	Allowed.
H. S. Paine and J. Hamilton	do.	Confections coated with fondant	Do.
Do.	do.	do.	Pending.
F. W. Reynolds and J. Hamilton	do.	Fondant centers	Do.
L. W. Tarr and C. L. Baker	States Relations	Pectin	Do.
L. H. Bailey	Chemistry	Bread	Allowed.
E. Bateman and T. E. Hubert	Forest Service	Stain preventer	Pending.
A. T. Goldbeck	Public Roads	Marking strip for concrete roads	Do.
H. D. Tiemann	Forest Service	Kiln	Do.
M. E. Dunlap	do.	Hygrometer	Do.
J. H. Cox	Agricultural Economics	Grain sieve	Do.
B. C. Kadel	Weather Bureau	Rain gauge	Allowed.

**CONDITION OF THE WORK OF THE OFFICE**

The work of the office, considering its nature, is current.















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